

REPORT

ON THE

AGRICULTURAL EXPERI- MENTS AND DEMON- STRATIONS IN ASSAM

FOR THE

YEAR ENDING THE 31ST MARCH 1922.



SHILLONG:

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GLOSSARY.

Arhar...	Cajanus Indicus.
Aus	Autumn rice.
Asra	A short stemmed variety of deep water winter rice.
Aman...	...	...	A long stemmed deep water paddy.
Boro ...	...	...	Transplanted spring rice.
Cowpea	...	...	Vigna catianga.
Dhaincha	...	...	Sesbania aculeata.
Groundnut	...	...	Arachis hypoga.
Gram	...	...	Cicer ariselinum.
Jowar...	...	...	Andropogon soghum var-vulgare.
Kharif	...	...	The rainy season.
Kalai	...	...	Phaseolus mung var-radiatus.
Kobsari	...	...	Lathyrus sativus.
Masur	...	...	Lens esculenta.
Mung	...	...	Phaseolus mungo.
Oats ...	...	...	Avena Sativa.
Paddy	...	...	Oriza Sativa.
Peas ...	...	...	Pisum Arvense.
Rape...	...	...	Brassica Campestris.
Sugarcane	...	...	Sacharum officinarum.
Sail...	...	...	Transplanted winter rice.
Tola ...	...	...	125 lbs.
Wheat	...	...	Triticum vulgare.
Beer reens	...	...	Trifolium alexandrinum.
Raishan	...	...	Paspalum Sanguinale.
Maund	...	...	82½ pounds.
Kuz	...	...	A system of cultivation consisting of paring and burning the surface.
Kulthikalai	...	...	Dolichos biflorus.
Soy bean	...	...	Glycine hispida.
Guinea grass	...	...	Panicum jumentorum.
Rhodes grass	...	...	Chloris gayana.
Ails ...	...	...	Raised earthen boundary lines.
Bunds	...	...	Embankments.

REPORT OF THE JORHAT AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING THE
31st MARCH 1922.

1. *Introduction.*—This station is situated about 3 miles south of Jorhat, Sibsagar district, Assam Valley, at an elevation of about 296 feet with the mean maximum temperature of 82.6° and mean minimum temperature of 63.1° and was established in the beginning of the year 1906. It was intended principally for sugarcane work. Since then, on account of peculiar soil conditions which altogether precluded the growth of most *rabi* crops even in the presence of abundance of soil moisture, the work has been extended to include a study of the factor causing this sterile condition with a view to its amelioration. This work has been going on since 1908, and we are now in a position to state that the sterile condition of the soil to most crops in the cold weather, and also to certain crops in the rains, is due to the accumulation of acid substances, amongst them being a specific toxin which has been isolated and experimented with in culture solutions, with effects on the plant's root system and growth precisely similar to those observed in the field; these are readily neutralised and rendered harmless by dressings of lime or other base to the soil. An account of the experimental results leading up to this conclusion has been published as a memoir of the Department of Agriculture in India, Chemical Series, Volume III, No. 9, entitled "Studies of an acid soil in Assam."

In connection with the improvement of the soil by liming the application of other fertilizers has been studied, and our regular scheme of manuring now includes green manuring and the application of raw phosphates. Phosphoric acid has an effect second only to that of lime on these soils, but is preferably used in a basic form such as basic slag, for instance, rather than in the form of superphosphate. While small initial applications of the latter act beneficially, its application in very large doses or its continued use over a number of years in our own experience is clearly detrimental in the absence of periodic lime dressings on sour soils. If used in conjunction with lime, however, the case is quite a different one.

The original area of the station was about $35\frac{1}{2}$ acres, of which 1.7 acres is *hola* or ravine land and the remainder high land, which was under grass and scrub jungle at the time of

acquisition. An additional area of about 24 acres has since been acquired, of which about 4 acres is *hola* land and the remainder high land.

The total area at present is thus 59½ acres. Most of the newly added area has been put under cultivation and is being treated uniformly in blocks with a view to future experiments.

2. *Soil*.—The soil of the high land is a reddish sandy loam of the old alluvium, lying on a hard greyish yellow sub-soil. Where the conditions have not been improved by cultivation, the soil is extremely shallow, varying from only 3 to 6 inches in depth:—

Report of analyses of Jorhat Farm soil by the Agricultural Chemist, Assam.

—	Surface soil.	Sub-soil.
	Laboratory No. 5.	Laboratory No. 5(a)
1	2	3
A.	Per cent.	Per cent.
<i>Soluble in hydrochloric acid with 12 hours' digestion at 100 C:—</i>		
Phosphoric acid ($P_2 O_5$) ...	0.025	0.020
Potash ($K_2 O$) ...	0.115	0.135
Lime ($Ca O$) ...	0.154	0.144
Magnesia (MgO)...	0.166	0.148
B		
<i>Soluble in one per cent. citric acid with 7 days' digestion:—</i>		
Phosphoric acid ...	0.008	0.008
Potash ...	0.007	0.011
C		
Loss on ignition (organic matter and combined water) ...	3.26	1.84
Nitrogen ...	0.115	0.051
Calcium carbonate ...	0.018	0.018
Reaction ..	Acid	Acid.

These analyses agree quite well generally with some others made some years ago by the Imperial Agricultural Chemist.

These samples are acid in reaction, and the total lime present in all combinations, as well as the carbonate of lime, is quite deficient in quantity.

The amount of organic matter is probably greater than obtains in many Indian soils, but there is no doubt that a light soil of this character will be much improved in many ways by an increase in the amount of humus.

A good deal of the organic matter present is of doubtful character and consists very probably old residues of little value; it is the presence and active decay of comparatively recent additions of organic matter which puts life into a soil.

The percentage of nitrogen present in the surface soil is what would normally be considered a fair one, but in view of the absence in anything like adequate quantity of carbonate of lime, conditions for nitrification and soil bio-chemical processes generally are probably not as favourable as they might be by a long way, and an increase in the amount of nitrogen is indicated as desirable.

Of potash there is no dearth, and there would seem to be no immediate need for potash manuring.

Regarding phosphoric acid, these samples show a deficiency both in "total" as well as "available" supplies. There is thus a "real" as opposed to a mere temporary lack in respect of this element of plant food.

This lack of phosphoric acid is further aggravated by the absence of sufficiently large amounts of lime carbonate and humus high percentages of which may, and often do, offset a smaller percentage of phosphoric acid.

An acid condition of soil, besides being harmful in itself very often brings about a more rapid depletion of the soil's stock of phosphoric acid, in consequence of which most soils of a decidedly acid character are found to be lacking in this element and to respond to its suitable application.

The sub-soil is capable of very great improvement indeed as the figures show, but it would probably be immediately disastrous to work it so deeply as to bring any considerable amount to the surface at once.

The growth of deep-rooting legumes as green crops will assist materially, but if the sub-soil could be stirred occasionally, while at the same time the surface cultivation is gradually deep-

ened so that the green crops may be more deeply buried, a greater depth of surface soil will result, which on this farm is very much to be desired.

I am convinced that for cane cultivation, until the surface soil has been deepened and the amount of humus increased, it is of little use attempting manurial experiments on cane with artificial manures, no amount or combination of the latter can ever make up, in the case of crop like sugarcane, for loss of fertility due to shallow cultivation and lack of "humus".

3. *Rainfall.*—The rainfall recorded at the civil station of Jorhat during the year under report is given below together with the normal rainfall each month :—

—	Month.	Rainy days.	Actual, (inches).	Normal, (inches).
1	2	3	4	5
1921 ...	April ...	19	11.47	8.82
	May ...	15	11.96	9.72
	June ...	19	8.62	11.23
	July ...	18	10.39	15.11
	August ...	19	15.11	15.03
	September ...	14	13.53	9.40
	October ...	12	5.68	4.23
	November ...	Nil.	0.12	0.72
	December ...	4	1.49	0.57
	January ...	3	0.84	0.99
1922 ...	February ...	1	0.29	1.47
	March ...	5	3.81	3.81
	Total ...	129	83.31	81.10

Our own rain gauge had been set up in the Laboratory compound near the Farm and regular record is being kept from the 24th August 1921. The monthly rainfall recorded here gives the following figures: 12.52", 4.69", 0.00", 1.11", 0.71", 0.05" and 2.75" from September 1921 to March 1922 and show a marked deficiency in comparison with the rainfall at the Jorhat town.

Though the total rainfall did not differ much from the normal, the season had some remarkable points in it. The heavier rainfall in April and May was favourable for planting and early growth of the cane, the drier June and July must have been convenient for after cultivation while the higher precipitation in September and December made the ripening season somewhat late.

4. *Experimental Work.*—This includes the following :—

- I. Sugarcane experiments, varietal, manurial and introduction of new varieties.
- II. Soil investigations and manurial experiments.
- III. Trials of new crops or new varieties, pulses, green crops, etc.
- IV. Trials of fodder crops.

5. Abstract cropping scheme for 1921-22 :—

Abstract cropping scheme for 1921-22.

Name and description of blocks.	Acreage under cultivation.	Treatment and crops.	
		During rains.	During cold weather.
1	2	3	4
A.—Sugarcane rotation and phosphatic experiment block.	2.00	Ratoon	Canes.
B.—Sugarcane rotation and phosphatic experiment block.	3.00	Dhaincha green manure,	Oats.
C.—Wood ashes experiment block	1.25	...	Oats.
D.—Sugarcane rotation and phosphatic experiment block.	3.38	Plant	Canes.
E.—Sugarcane rotation and phosphatic experiment block.	4.01	Cowpea green manure.	Mustard-soiled.
F.—Sugarcane rotation ...	1.44	Cowpea green manure.	Mustard soiled.
G.—Old liming experiment block...	.33	Cowpea green manure.	Oats.
H.—General cultivation block ...	.90	Dhaincha green manure.	Cowpea for seed.
K.—Lime experiment block ...	.75	Chemical manuring experiment.	

Name and description of blocks.	Acreage under cultivation.	Treatment and crops.	
		During rains.	During cold weather.
1	2	3	4
L.—Liming, deep and shallow cultivation block.	2.00	Cowpea green manure.	Wheat.
M.—Liming and cane rotation block	2.00	Dhaincha green manure.	Oats.
M.—North.—Grass area ...	0.41	Guinea grass.	
N.—Cane rotation block ...	1.00	Plant canes.	
O.—East.—Cane rotation block ...	1.50	Ratoon canes.	
O.—West.—Cane rotation block ...	1.27	Plant canes.	
P.—General cultivation block ...	0.88	Cowpea green manure.	Fallow.
Q.—Grass area ...	1.00	Guinea grass.	
R.—General cultivation area ...	.50	Arhar.	
Kitchen garden ...	.79	Cotton and Burma beans.	
Orchard ...	1.00	Brat.	

6. *Sugarcane*.—This work includes the acclimatisation, testing and selection of varieties, exotic and local, under chemical control; also manurial and other experiments in the cane rotation, and the distribution of suitable varieties in due course to cultivators. The varieties distributed this year from the farm were Stripped Mauritius, B 147, J33a, D74, and Co 9, the latter two for the first time.

The planting season in 1921 was a very favourable one, and the young crop did very well all over, subsequent growth and maturation of the crop being about normal.

A number of new varieties were under observation and test.

7. *Sugarcane varieties. Ratoon cane Block A.*—The following 20 varieties planted in this block in 1920 were ratooned :—

B 147, Striped Mauritius, Red Mauritius, White Mauritius, J 33a, J 36, J 213, J 139, J 247, Magh, B 376, B 3412, B 6450, D 74, Co. 9, Co. 1, Mauritius 55, Mauritius 131, Mauritius 90 and A 2a.

The results for the previous plant cane crop appeared in paragraph 8 of last year's report. In the early growing period frequent inter-cultivation was given by the single bullock spring-tyned cultivator. The crop was earthed up when 3 to 4 feet high, two doses of oil-cake, each supplying 50 lbs. Nitrogen per acre being applied, one at either earthing. The plots were harvested January, February 1922.

The local variety, Mag, as usual ratooned miserably; other varieties notably the Striped, White and Red Mauritius canes, also B 376 were badly lodged by storms and their quality suffered in consequence.

A cane which stands up is certainly a desideratum for the Assam Valley and some of the newer importations, viz., D 74, J 33a, Co 9, are quite good in this respect.

The crop results and analysis appears in Tables I and II. The average crop was good for ratoons, working out at 25 tons stripped cane per acre for the whole twenty varieties.

TABLE I.

Block A.—*Ratoon Cane, 1921-22—Varieties (Non-phosphated area).*

Variety.	Plot No.	Plot area.	Cane lbs. per acre.	Juice lbs. per acre.	Expression.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity coefficient of juice.	Sucrose in expressed juice lbs. per acre.	Remarks.
1	1	2	3	4	5	6	7	8	9	10	11
B 147	1	1 ⁶	50,220	31,500	62.7	Per cent. ...	Per cent. ...	...	...	...
Striped Mauritius	2	"	65,800	41,660	63.3	14.07	1.12	7.9	89.0	5,362
B 376	3	"	45,840	28,900	63.0	13.00	1.12	8.6	86.6	3,757
J 33a	4	"	78,000	46,400	59.4	12.26	1.95	15.9	81.0	5,689
Magh	5	"	12,440	7,480	60.0	...	...	...	...	...
B 3412	6	"	78,920	50,520	64.0	...	...	...	...	...
B 6450	7	"	57,940	37,080	63.9	14.11	0.97	6.9	89.1	5,232
Red Mauritius	8	"	63,440	39,380	62.0	14.94	0.99	6.5	90.1	5,883
White Mauritius	9	"	65,800	42,990	65.3	14.71	1.17	7.9	88.6	6,324
D 74	10	"	66,820	41,960	62.6	12.91	1.59	12.3	83.9	5,404
C o 9	11	"	59,400	37,590	63.2	17.27	0.44	2.5	93.3	6,492

Mauritius 55	...	13	...	55,840	38,500	65.3	11.90	2.03	17.1	86.4	4,344	1,402
J 86	...	14	...	55,140	31,580	57.2	15.55	0.91	6.9	88.3	4,911	
J 213	...	15	...	67,840	40,560	59.7	15.81	0.71	4.5	92.4	6,413	
J 139	...	16	...	47,720	27,250	57.1	15.73	0.70	4.4	89.2	4,287	
Co 1	...	17	...	27,100	15,160	55.9	15.89	0.46	2.9	91.7	2,409	
J 247	...	18	...	53,120	31,340	58.9	14.15	1.07	7.6	86.3	4,435	
Mauritius 131	...	19	...	41,740	26,320	68.0	13.65	1.39	10.2	85.8	3,593	
Mauritius 90	...	20	...	31,780	18,570	58.4	12.45	0.99	8.0	85.4	2,312	

TABLE II.

Block A—Ratoon Cane, 1921-22—Varieties (Phosphated area).

Variety.	Plot No.	Plot area.	Cane lbs. per acre.	Juice lbs. per acre.	Extraction.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity coefficient of juice.	Sucrose in expressed juice lbs. per acre.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
B 147	...	1	57,640	35,920	62.3	14.6	1.07	7.3	88.1	5,245	
Striped Mauritius	...	2	71,940	46,200	64.1	14.00	1.14	8.2	88.6	6,468	
B 376	...	3	50,540	31,080	61.4	13.04	1.17	9.8	88.1	4,053	
J 33a	...	4	78,600	47,200	60.0	12.20	1.95	16.0	80.6	5,759	
Magh	...	5	16,620	9,700	62.0	9.36	2.17	23.2	72.5	908	
B 3412	...	6	78,960	49,920	63.2	11.45	2.07	18.1	80.5	5,716	
B 6450	...	7	68,740	43,340	63.0	14.29	0.97	6.8	89.6	6,193	
Red Mauritius	...	8	66,880	41,380	61.8	14.06	1.05	7.5	88.8	5,818	
White Mauritius	...	9	69,940	45,140	64.5	13.61	1.29	9.4	86.7	6,143	
D 74	...	10	72,040	45,080	62.5	11.88	1.82	15.3	81.5	5,356	
		Acre.			Per cent.	Per cent.	Per cent.		Per cent.		

Co 9	...	11	...	61,560	39,200	63.3	16.59	0.57	3.4	92.6	6,503
A 2a	...	12	...	78,320	49,760	63.5	17.94	0.44	2.5	94.4	8,927
Mauritius 53	...	13	...	53,040	34,440	64.8	9.56	2.49	26.0	73.9	3,292
36	...	14	...	58,040	33,660	67.8	15.81	0.84	5.3	89.3	5,306
J 213	...	15	...	71,060	41,340	68.1	15.28	0.79	5.1	89.9	6,317
J 139	...	16	...	48,820	28,080	68.1	14.81	1.04	7.0	85.9	4,159
Co 1	...	17	...	32,680	18,020	66.2	16.89	0.45	2.7	93.0	3,044
J 247	...	18	...	46,620	27,260	68.4	15.25	0.88	5.8	88.8	4,157
Mauritius 131	...	19	...	44,720	28,300	63.2	12.45	1.47	10.9	84.2	3,807
Ditto 90	...	20	...	83,040	19,340	68.5	12.78	0.94	7.4	85.5	2,472

The heaviest crops were produced by B 3412, J 33a, A 2a, J 213, D 74, Striped Mauritius and Co 9, in the order named, the average crop for these seven varieties being 32 tons per acre. Having regard however to quality we find that variety A2a returned on the average some $3\frac{3}{4}$ tons Sucrose per acre in expressed juice, followed by Co 9 with 2.9 tons, closely followed by J-213, Striped Mauritius, J33a and D74 in order.

Phosphated area.—The average yield of cane from the phosphated area for the twenty varieties under trial exceeded that from the unphosphated but otherwise similarly treated area by some 1.5 tons stripped cane per acre. In the preceding plant cane crop on this area, the average increase in favour of the phosphated area was 1.1 tons per acre. For the two crops, therefore net increase in favour of the phosphated area is only 2.6 tons per acre, an increase too small to set any value by.

8 *Sugarcane Varieties.*—*Plant Cane.*—*Block D.*—In the 4 course rotation adopted this block was last under cane in 1917-19, during the next two years it carried *dhaicha* as a green crop and oats in 1919, followed by cowpeas and rape in 1920. Previous to sowing the cowpeas in 1920 the whole block received 1,000 lbs. ground limestone per acre while the phosphated area was given 560 lbs. Flour phosphate in addition.

The following varieties were planted :—

Striped Mauritius, White and Red Mauritius, B147, B376, B3412, B6450, J33a, J33, J213, J133, J247, Co 1, Co 9, Mauritius 55, 131 and 90, D74, A2a and Magh sport.

The planting season was a very favourable one, planting taking place under ideal conditions.

Subsequent conditions were good, in consequence the cane broke away in fine style, rainfall was ample and well distributed, extending however rather late for early maturation of the crop.

Cultivation and manuring was the same for all plots, 100 lbs. nitrogen as cowdung being applied before planting, and two dressings of 25 lbs. nitrogen as oilcake subsequently, one at either earthing, making a total of 150 lbs. nitrogen per acre. The crop was harvested February-March 1922, and the results appear in Tables III and IV.

TABLE III.
Block D—Plant Cane, 1921-22—Varieties (Non-phosphated area).

Variety.	Plot No.	Plot area.	Cane lbs. per acre.	Juice lbs. per acre.	Extraction.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity coefficient.	Sucrose in juice lbs. per acre.	Remarks.
1.	2	3	4	5	6	7	8	9	10	11	12
		Acre.			Per cent.	Per cent.	Per cent.		Per cent.		
B 147 ...	1	1 1/2	73,930	47,250	63.8	17.28	0.50	2.9	92.9	8,165	
B 376 ...	2	"	64,610	41,960	64.9	13.24	1.15	8.7	86.7	5,556	
Striped Mauritius	3	"	84,000	53,370	63.5	16.13	0.87	5.4	91.1	8,608	
J 33a ...	4	"	75,270	43,809	58.1	15.25	1.25	8.2	86.9	6,850	
Red Mauritius	5	"	79,360	51,180	64.4	15.37	1.01	6.5	90.6	7,866	
White Mauritius	6	"	80,720	52,430	64.9	15.89	1.19	7.5	89.6	8,331	
D 74 ...	7	"	88,050	56,320	63.9	15.98	1.19	7.5	89.9	9,000	
C 0 9 ...	8	"	73,280	47,270	64.5	19.16	0.30	1.6	94.9	9,057	
B 6450 ...	9	"	57,990	39,080	67.4	17.71	0.49	2.8	93.2	6,921	
B 3412 ...	10	"	101,580	65,900	64.8	14.39	1.36	9.4	87.6	9,483	

TABLE III—*cont'd.*
Block D—Plant Cane, 1921-22.—Varieties (Non-phosphated area)—concd.

Variety.	Plot No.	Plot area.	Cane lbs. per acre.	Juice lbs. per acre.	Expres- sion.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co- efficient.	Sucrose in juice lbs. per acre.	Remarks
1	2	3	4	5	6	7	8	9	10	11	12
			Acres.		Per cent.	Per cent.	Per cent.		Per cent.		
J 36	...	11	54,540	33,330	61.0	15.76	0.84	5.3	89.9	5,253	
J 213	...	12	79,750	49,290	61.7	17.10	0.42	2.5	94.7	8,429	
J 139	...	13	52,210	30,130	57.7	14.42	1.14	7.9	86.2	4,344	
M 131	...	14	63,330	40,780	64.3	12.37	1.85	14.9	81.3	5,044	
J 217	...	15	85,880	52,060	60.5	16.38	0.64	3.9	91.2	8,526	
M 55	...	16	91,290	63,550	69.6	13.45	1.99	14.8	83.9	8,547	
Magh Sport	...	17	68,780	43,600	63.3	15.19	1.19	7.9	88.6	6,623	
A 2a	...	18	74,880	48,560	64.8	19.30	0.37	1.9	95.4	9,663	
Co 1	...	19	51,480	33,610	61.6	18.26	0.85	1.9	94.5	6,137	
M 50	...	20	59,440	37,830	63.5	14.40	0.84	5.9	89.3	5,448	

TABLE IV.
Plant Cane, 1921-22.—Varieties (Phosphated area).

Variety.	Plot No.	Plot area.	Cane, lbs. per acre.	Juice, lbs. per acre.	Expres- sion.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose in juice lbs. per acre.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
		Acre.			Per cent.	Per cent.	Per cent.		Per cent.		
B 147 ..	1	3½	79,990	60,300	62.8	16.32	0.68	4.2	91.3	8,209	
B 376 ..	2	"	71,020	46,710	64.3	13.33	1.12	8.4	87.3	6,093	
Striped Mauritius ..	3	"	84,670	63,140	62.7	15.67	0.88	5.6	91.2	8,327	
J 33a ..	4	"	80,820	47,210	58.4	13.62	1.47	10.8	83.9	6,430	
Red Mauritius ..	5	"	67,830	42,630	63.8	13.83	1.29	9.3	85.3	5,896	
White "	6	"	87,400	56,990	65.2	14.33	1.20	8.4	88.0	8,167	
D 74 ..	7	"	99,980	64,670	64.6	14.10	1.52	10.7	86.4	9,118	
C 0 9 ..	8	"	84,830	55,670	65.6	17.54	0.43	2.6	93.3	9,765	
B 6450 ..	9	"	64,230	42,680	66.3	15.51	0.63	5.3	89.7	6,612	
B 3412 ..	10	"	103,600	66,390	64.0	13.25	1.72	13.0	83.2	8,797	

TABLE IV—*concl'd.**Plant cane, 1921-22—Varieties (Phosphated area)—concl'd.*

Variety.	Plot No.	Plot area.	Cano. lbs. per acre.	Juicd. lbs. per acre.	Expres- sion.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose in juice lbs. per acre.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
		Acre.			Per cent.	Per cent.	Per cent.		Per cent.		
J 36	11	"	54,480	32,800	60.1	15.54	0.96	6.2	87.5	5,097	
J 213	12	"	78,410	47,090	60.0	17.01	0.61	9.6	92.9	8,010	
J 139	13	"	60,350	27,900	55.4	14.28	1.43	10.0	84.5	3,984	
M 131	14	"	66,830	41,130	62.0	12.97	1.66	12.8	81.4	5,335	
J 247	15	"	85,230	51,730	60.6	16.21	0.79	4.8	90.9	8,386	
M 55	16	"	78,870	51,910	65.8	14.22	1.98	13.9	84.8	7,381	
Magh sport	17	"	71,760	44,830	62.4	14.91	1.25	8.4	87.6	6,684	
A 2a	18	"	74,760	47,920	64.0	20.20	0.49	2.4	94.4	9,680	
Co 1	19	"	52,530	32,090	61.0	18.53	0.50	2.7	94.2	5,946	
M 90	20	"	58,670	37,440	63.7	11.53	1.44	12.5	81.6	4,317	

The average crop for the whole 20 varieties was some 33 tons stripped cane per acre. Individual records were as follows:— B 3412, 45·8 tons; D 74, 42 tons; J 247, 38·2 tons; Mauritius 55, 37·9 tons; Striped Mauritius 37·6 tons; White Mauritius 37·5 tons; J 213, 35·3 tons; Co 9, 35·3 tons; J 33a, 34·8 tons; B 147, 34·3 tons; A 2a, 33·4 tons; stripped cane per acre in all cases. The order is very considerably altered when sugar production is considered. Thus the amount of sucrose per acre in expressed juice for the above varieties was as follows in order:— A 2a, 4·31 tons; Co 9, 4·2 tons; B 3412, 4·08 tons; D 74, 4·04 tons; Striped Mauritius 3·78 tons; J 247, 3·77 tons; White Mauritius 3·68 tons; J 213, 3·67 tons; B 147, 3·65 tons; Mauritius 55, 3·55 tons.

Of the older varieties B 147 and Striped Mauritius continue to do well. B 376 appears to be deteriorating, chiefly on account, I think, of its great tendency to lodge, rendering it open to damage and disease.

Of newer varieties A 2a, Co9, D74, J247 and J213 have done very well indeed. The former two, A2a and Co9, are in a class by themselves in regard to quality; given careful selection for a few years against disease these two canes should do extremely well, more specially for estate work.

The other three, *viz.*, D74, J247 and J213 while being heavy croppers suffer somewhat by comparison with A 2a and Co9 in regard to quality. Again the latter two varieties are ready to mill at least a month ahead of the other three. Nevertheless in spite of all this, I am of opinion that under the average cultivator's treatment and conditions the heavier croppers of medium to good quality like D74, J213, B3412 will do better than the higher class canes such as Co 9 and A 2a, which require better cultivation and more careful handling than the cultivator commonly bestows. D 74 and J 213 are both canes of good habit, hard, upstanding, germinating well, and big croppers both in plant cane and ratoons though D 74 is late ripening with us. Another variety which should do well in cultivators' hands is B 3412 which for a number of years has recorded very heavy crops in both plants and ratoons of good medium quality. It gives a big outturn of *gur*, which after all is what the ryots aim at.

One point, however, one must emphasize as a result of some 15 years' experience and that is that given a few years' careless handling in the matter of selection of planting material, many of these superior varieties of cane will undoubtedly rapidly degenerate. Amongst other things, *e.g.*, better drainage, cultivation,

adequate manuring and earlier planting, etc., the selection of the best planting material year by year by the cultivator must be insisted on by the Department, if these introduced varieties are to stand up for any length of time.

Phosphated area.—The average increase in crop for all varieties on the phosphated area amounted only to $\frac{3}{4}$ ton stripped cane per acre. The increase was greater in some varieties than others. No value can be attached to so small an average increment. From several years' experience it appears quite certain now that so far as the cane crop is concerned the amount of phosphoric acid added directly to this crop in the cowdung and cake supplied, is quite sufficient to carry heavy crops of cane. The other crops, however, in the rotation, viz., green manures, oats and rape undoubtedly respond well to the mineral phosphate dressing.

Another point is noticeable, viz., that while the phosphate area returns somewhat bigger cane crops, the quality of the juice is on average better in the case of cane grown without the extra phosphate. Thus for the 20 varieties grown this year, the average sucrose content of the juice was nearly 1 per cent. higher on the unphosphated area, with a consequent diminution in invert sugar content. This might be accounted for by a higher soil nitrogen content on the phosphated area, which has been observed on certain of our cane blocks of recent years. The larger green-manure crops regularly produced on the phosphated areas, together with an increase in the nitrogen percentage in green crop composition, actually observed, would go some way to establish a higher soil nitrogen content on these phosphated areas, but this does not preclude increased symbiotic nitrogen assimilation by soil organisms under the stimulation of an enhanced supply of phosphoric acid and organic matter.

9. New varieties of cane.—Seven new varieties under trial were nurseried. These consisted of five new varieties received direct from the Java Sugar Experiment Station in 1919, viz., P.O.J 1547, 100, 1499, 2379 and 1507. Other two, H 109 and Badila were sent from Coimbatore in 1920.

These all grew normally except Badila which was stunted in growth. It may, however, acclimatise though it appears to need more tropical conditions.

Four of the new Java canes flowered early, one J 1499 being in full flower by mid November, the others J 1547, J 100 and J 1507 at that time just forming their flowering spikes. J 2379 does not flower at all.

Ripening tests were commenced early in December 1921 on these five Java varieties together with Striped Mauritius as a standard for comparison, and also on D 74 and Co 9.

The results appear in Table V, and are of interest in connection with our search for early ripening canes. Thus early in December when the canes were but $8\frac{1}{2}$ months old, J 1499 (the first variety to come into flower) showed over 16 per cent sucrose in juice, beating Striped Mauritius with 15.25 and Co 9 with 14.05, D 74 then containing only 8.46 per cent.

TABLE V.

Ripening tests on new varieties under trial, 1921-22.

Variety.	Date.	Juice ex- pres- sion.	Sucrose in juice.	Invert sugars in juice.	Total solids in juice.	Glucose ratio.	Purity co-efficient of juice.	Remarks.
1	2	3	4	5	6	7	8	9
Striped Mauritius (as standard).	3rd December 1921	Per cent. 75.2	Per cent. 15.25	Per cent. 1.33	Per cent. 17.48	8.7	87.2	Cane 8½ months old on 5th December 1921. Canes did not flower.
	18th February 1922	...	16.63	0.62	17.91	9.7	92.8	
	5th December 1921	68.0	16.14	0.81	17.87	5.0	90.3	
	4th January 1922 ...	67.8	16.78	0.45	18.2	2.68	92.2	
J-1499	17th February 1922	68.2	17.41	0.25	18.6	1.43	93.7	Cane 8½ months old on 5th December 1921. In full flower by Novem- ber 15th, 1921.
	20th April 1922 ...	60.4	17.58	0.30	18.37	1.7	95.7	
	6th December 1921	69.9	13.42	1.52	15.77	11.2	85.1	
	4th January 1922 ...	69.8	14.80	0.90	16.6	6.1	89.1	
J-1507	17th February 1922	69.9	15.81	0.58	17.47	3.67	90.5	Cane 8½ months old on 5th December 1921. Flowered freely in Decem- ber.
	19th April 1922 ...	68.8	16.81	0.31	17.70	1.84	94.9	

J-1547	7th December 1922	72.1	18.98	1.43	16.2	10.2	86.3	Cane 8½ months old on 5th December 1921. Flowered freely in December.
	6th January 1922 ...	73.1	15.87	0.81	17.2	6.2	80.5	
	17th February 1922	71.3	17.03	0.34	18.24	1.99	93.8	
	20th April 1922 ...	71.3	17.19	0.30	17.84	1.74	96.3	
J-100	9th December 1921	75.2	11.54	...	14.99	...	77.0	Cane 8½ months old on 5th December 1921. Flowered freely in December.
	5th January 1922 ...	75.6	13.33	1.98	16.09	14.8	83.8	
	20th February 1922	74.1	16.61	0.81	18.2	4.8	91.2	
	8th December 1921	73.4	12.12	2.16	15.02	17.8	80.7	
J-2379	5th January 1922 ...	71.8	14.30	1.28	16.6	8.95	86.1	Cane 8½ months old on 5th December 1921. No flowers.
	20th February 1922	72.1	15.52	0.98	17.41	6.3	89.1	
	13th April 1922 ...	70.0	17.35	0.56	18.71	3.2	92.7	
	1st December 1921	75.0	8.46	...	12.33	...	68.6	
D-74	6th January 1922 ...	75.0	10.34	2.37	13.55	23.1	75.5	Cane 8½ months old on 5th December 1921. No flowers.
	1st March 1922 ...	...	15.98	1.19	17.77	7.5	89.9
	2nd December 1921	75.6	14.05	1.54	16.37	10.9	85.8	
Co-4	13th January 1922	73.3	17.68	0.47	18.45	3.7	92.5	Canes flowered here and there.
	2nd March 1922 ...	...	19.16	0.30	20.19	1.6	94.9

But in early January J 1499 and Co 9 gave juices of about the same composition and purity, containing some 17 per cent. sucrose easily leading all others at this time. Thus we appear to have in J 1499 a distinctly early ripening cane, but this will need confirmation in future years.

The figures also show that although some of these varieties flowered early and very freely, the juice continued to improve in quality at any rate for four months after flowering, and the juice expression did not fall off to any appreciable extent.

The difference in varieties as regards time of ripening is well instanced by D 74 and J 1499, the former containing about the same amount of sucrose in juice early in March as the latter did three months earlier. D 74 with us in the Upper Assam Valley is not ready to harvest before March, and will improve if left into April.

10. Sugarcane Manurial Experiment.—*Striped Mauritius*.—*Plant Cane*.—In view of the improved soil conditions on our cane areas consequent upon the rotation and scheme of manuring carried out now for many years, it was considered that the amount of Nitrogen directly added to the plant cane crop, *viz.*, 150 lbs. Nitrogen per acre, is now possibly excessive. Over-manuring with Nitrogen might result in three things, (1) increased loss of Nitrogen in drainage, (2) greater liability of the cane to disease by over stimulation, and (3) increased lodging of the crop leading to loss by damage and deterioration.

An experiment was laid down in Block D in 1921 to test the point. The whole of the plots were treated alike in regard to the basal dressing of cowdung, *i.e.*, 250 maunds per acre supplying 100 lbs. Nitrogen per acre. Three series of duplicate plots received the following additional manuring :—

- (a) no further Nitrogen.
- (b) 25 lbs. Nitrogen per acre, as oilcake at earthing up.
- (c) 50 lbs. Nitrogen per acre, as oilcake at earthing up.

Unfortunately the cane over the whole area was very badly knocked about and laid by a heavy storm in August, which spoiled the experiment. The figures are given in Table VI for what they are worth. As regards yield of cane duplicate plots Nos. 3 and 4 agreed very well indeed, while Nos. 5 and 6 agreed fairly well. Nos. 1 and 2 however differed widely and vitiated the experiment. Again all the plots agreed closely in quality of juice, with the exception of plot No. 6 which was down. Unequal damage caused by the storm mentioned may probably account for these discrepancies. So far as the experiment goes it appears to support the suspicion that our manuring for the plant cane crop is excessive.

TABLE VI.

Mauritius Experiment, 1921-22—Figures are per acre.

Variety.	Plot No.	Manuring.	Cane lbs. per acre.	Juice lbs. per acre.	Extraction.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Gr lbs. per acre.	Sucrose lbs. per acre in juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13
Striped Mauritius plant cane.	1	100 lbs. Nitrogen per acre at planting in the form of cowdung.	83,200	52,720	63.3	16.32	0.82	5.0	92.5	8,600	8,604	Average 7,969.
	2	Plus no further Nitrogen.	67,600	44,100	65.2	16.63	0.62	3.7	92.8	7,900	7,334	
	3	100 lbs. Nitrogen per acre at planting in the form of cowdung.	76,760	40,740	64.7	16.86	0.62	3.7	93.1	8,760	8,386	Average 8,253.
	4	Plus 25 lbs. Nitrogen as oilcake as two top-dressings.	75,800	40,160	61.0	16.52	0.76	4.6	92.6	8,500	8,121	
	5	100 lbs. Nitrogen per acre at planting in the form of cowdung.	79,060	50,300	63.6	16.39	0.82	5.0	92.2	8,860	8,244	Average 7,779.
	6	Plus 50 lbs. Nitrogen as oilcake as two top-dressings.	75,480	48,920	64.8	14.95	1.01	6.7	90.0	7,620	7,314	

The experiment is being repeated on a non-lodging variety of cane, with more duplication of plots.

11. *Soil Investigations and manurial tests.*—The various experiments described in previous reports were continued.

The work includes :—

Block G	...	Liming experiment commenced in 1919.
" C	...	Liming and manurial experiment; also an experiment in the use of wood ashes as a soil ameliorant, both commenced in 1911.
" K	...	Experiments to elucidate the function of lime on our sour old red alluvial soil and to test the action of various manures and mixtures thereof, with and without lime, commenced in 1912.
" L	...	Ground Limestone experiment commenced in 1913 to test the effect of incorporating lime with the soil to varying depths.
Blocks E. B. A., and D	...	Experiments in the use of raw mineral phosphate in the sugarcane rotation. For previous details the earlier reports may be consulted.

12. *Block C. — Lime and Manurial Experiment.*—This experiment, commenced in 1911, has for its chief object to discover whether lime is best applied in large occasional doses or in more frequent smaller dressings. During the first six years of the experiment each of the lime sections received a total of 2 tons of slacked lime per acre, either (a) as one initial application of 2 tons or (b) as two equal triennial dressing of 1 ton each, or (c) in six equal annual doses of $\frac{1}{3}$ rd ton each. Since 1917 the experiment has been continued without further use of lime, for residual effect. Briefly it may be said that during the first few years of the experiment the larger and less frequent lime applications return the biggest crops. By about the fifth year the smaller more frequent dressings were returning larger yields. The cropping in this, the 11th year of the Experiment, was as follows :—

		Rains.	Cold weather.
Non-green manured block	...	Jowar ...	Oats.
Green-manured block	...	Cowpeas (green-manure)	Oats.

The *jowar* germinated normally on all plots, but died off early on the plots 1A and 1B which got no lime or cowdung. A few stunted plants carried through on the unlimed plots where cowdung was applied. The limed plots behaved normally. Oats germinated well, also dying off on plots 1A and 1B and 5B, where no lime or cowdung was applied.

The *rabi* season was a good one for cereals, good winter rains helping the crops. The limed plots, sections C and D, which got cowdung in addition, carried good crops, plot 6 yielding some $14\frac{1}{2}$ maunds grain per acre. The figures for the two crops appear in Table VII..

TABLE VII.
Block C.—Eleventh year of Experiment, 1921-22.—(Figures are per acre.)

Cross-dressings below.	Non-green-manured Blocks.				Green-manured Blocks.			
	No lime.	Lime total 4,800 lbs., i.e., 800 lbs. annually for 6 years from 1911-1916.	Lime total 4,800 lbs., i.e., 800 lbs. annually for 6 years from 1917, 1918 and again in 1914.	Lime 4,800 lbs. annually for 6 years from 1911.	No lime.	Lime total 4,800 lbs., i.e., 800 lbs. annually for 6 years from 1917-1916.	Lime total 4,800 lbs., i.e., 2,400 lbs. in 1913 and again in 1914.	Lime 4,800 lbs. annually for 6 years from 1911.
A Nil ...	Plot 1 Lbs. J=0 O=0	Plot 2 Lbs. J=5,080 O=190	Plot 3 Lbs. J=5,090 O=270	Plot 4 Lbs. J=3,410 O=110	Plot 5 Lbs. O=0	Plot 6 Lbs. O=360	Plot 7 Lbs. O=390	Plot 8 Lbs. O=330
B Bonemeal 240 lbs. per acre annually 1st to 6th year, i.e., 1911-1916.	J=0 O=0	J=5,440 O=300	J=6,030 O=80	J=5,340 O=140	O=0	O=630	O=640	O=620
C Bonemeal 240 lbs. per acre annually 1st to 6th years, plus cowdung 8,000 lbs. annually since 1911 to date.	J=1,830 O=10	J=15,550 O=720	J=17,660 O=660	J=18,900 O=660	...	...	...	...
D Cowdung 8,000 lbs. annually since 1911 to date.	J=1,070 O=30	J=16,410 O=720	J=17,910 O=900	J=22,410 O=860	O=40	O=1,160	O=1,080	O=760
				
					O=140	O=910	O=1,110	O=990

J=Green, F=Feet,
O=Oats, S=Straw.

The two features which again stand out in clear relief are first the continuing potent lime influence although no lime has been used since 1916, and second the beneficent effect of nitrogenous organic matter. Thus the oats from the whole of the manured plots was 1.55 times the crop from the non-green manured plots. Again, considering the crops over the whole area, the cowdung plots produced 3.66 times the crop of *jowar* and 2.58 times the crop of oats, respectively, yielded by the otherwise similarly treated plots but without cowdung.

The cowdung effect on oats on the non-green-manured block was naturally a greater one than that on the green-manured area, since the former block has carried a previous crop of *jowar*, the ratio being 3.53 to 1 for the non-green-manured area, and 2.15 to 1 for the green-manured.

Speaking generally the bonemeal effect was quite negligible the totals for both crops over the whole area being almost identical for the series of bonemeal plots and the otherwise similarly treated series of plots which got no bonemeal.

When one considers, however, the green-manured and non-green-manured blocks separately, in regard to bonemeal action, the result favours the green-manured area, where the series of bonemeal plots gave 1.14 times the crop of oats yielded by the non-bonemeal plots, while on the non-green-manured area the corresponding series of bonemeal plots yielded actually slightly less (*i.e.*, 0.90 to 1) than the non-bonemeal series. This result seems to point to some solvent action of the green-manure on the insoluble phosphate of the bonemeal.

As regards the relative efficacy of the differential lime dressings applied between 1911-1916, the results for oats clearly confirm those of recent years as against the earlier years of the experiment. Considering the oats crop either for the two blocks separately, or combined, the result is the same; the sections which received the lighter but recurrent lime dressings beat that which had a large initial single dose, plots 3 and 7 beating plots 2 and 6 the latter again leading from plots 4 and 8.

The evidence of the *jowar* crop this year on the un-green-manured blocks was not in the same direction, however, though two years ago the yield of this same crop agreed with the above observations for oats. The appearance of the *jowar* on plots 4C and 4D this year led one to suspect that at some time recently cowdung had been dumped in a heap on these plots previous to spreading, which is of course strictly against all orders. If this had happened it would explain the divergence of this year's

results so far as *jowar* is concerned, and incidentally it ruins the two plots mentioned, so far as accuracy of future results is concerned.

13. *Wood Ashes Experiment*.—Five plots since 1911 have been dressed respectively with 5, 10, nil, 15 and 20 maunds wood ashes per acre per annum. Half of each plot is cross-dressed annually with 100 maunds cowdung per acre.

The cropping this year was *jowar* followed by oats. Results per acre were as under :—

Manuring.	Outturn.	
	<i>Jowar</i> .	Oats (grain).
1	2	3
Plot 1. (a) 5 mds. ashes	133 lb.	14 lbs.
(b) 5 " " plus	1,232 "	42 "
100 " cowdung	819 "	56 "
Plot 2. (a) 10 mds. ashes	4,354 "	420 "
(b) 10 " " plus	0 "	0 "
100 " cowdung	0 "	0 "
Plot 3. (a) 0 ashes	2,737 "	252 "
(b) 0 ashes plus	11,025 "	616 "
100 mds. cowdung	8,673 "	728 "
Plot 4. (a) 15 mds. ashes	20,111 "	1,050 "
(b) 15 " " plus		
100 " cowdung		
Plot 5. (a) 20 mds. ashes		
(b) 20 " " plus		
100 " cowdung		

These results are in keeping with those of previous years, and go to prove conclusively what vast improvement in cropping is within the cultivator's reach if he will only intelligently conserve and apply along with his cowdung, the ashes every one of them annually produces.

The teachings of the lime experiment in Block C and also of this experiment during the past decade are of the greatest potential value to cultivators in the Assam Valley. It is no mean thing to have established the fact that with the use of lime or ashes *plus* cowdung not only is a much greater variety of cropping open to the ryot, but the outturn of most crops, both rains and *rabi*, may be enormously increased.

The evidence elucidated in support of the above statement not only from these two experiments but also from our experience with various crops all over the farm area, but more particularly in the cane rotation blocks, during the past 15 years is simply overwhelming and incontrovertible. Whether and what extent the lessons of our work will be applied by cultivators generally one hesitates even to guess, but they have received but the tardiest recognition and application hitherto. Possibly only harder times, the result of the pressure of increased population, will ever see this work applied as it should be, as it deserves to be and could profitably be.

14. *Block K.—Experiment on the function of Lime.*—This experiment was laid down 10 years ago to elucidate the reasons underlying the action of lime on the highland soil, and to study the effect of various artificial manures and mixtures thereof, used in conjunction with lime and without it. It is convenient to review those 10 years' work.

The initial work showed clearly that the application of any base, be it lime, magnesium carbonate or even sodium carbonate sufficed to produce a crop of oats in the cold weather, and that the prime requirement of the soil was for a base of some sort. Subsequent work has not altered the truth of this. With the exception of the basic phosphate, and also of superphosphate which initially exerted a slight beneficial action, the ordinary fertilisers had no influence on cropping in the absence of lime, while one such, *viz.*, sulphate of ammonia, proved to be very deleterious when so used, even to the extent of killing out weeds.

During subsequent years the cropping has been varied, including oats, *jowar*, cowpeas, *dhaincha*. The *jowar* crop emphasized the need of a base, and indicated more clearly than others the importance of phosphatic manuring. With this crop it was evident that only after the soils requirements for lime and phosphoric acid had been met could one expect a favourable response to additions of other artificials supplying potash and nitrogen.

A comparative study of the cowpea crop and oats showed that for any given crop the amount of acidity that any crop can stand is a function both of the nature of the crop and the amount and variety of plant foods presented to its roots.

Dhaincha, responded much more markedly to potash than the other crops, with or even without lime; in 1921 the action of potash on this crop, even when used in the absence of other fertilisers was quite strong.

An excessive lime dressing of 10 tons per acre produced chlorosis in the cowpea crop, during the first year or two after application, but excepting for *dhaincha*, where the yield this year was somewhat depressed, it did not appear to adversely effect other crops. With lapse of time those heavy lime plots may now be easily picked out by the extraordinary dark foliage of the cowpea crop in the rains.

While superphosphate initially exerted a slight beneficial action, its continued use alone, without lime, has proved to be quite ineffective, whereas the basic forms of phosphate, e.g., basic slag, flour phosphate, etc., have shown up to advantage throughout.

As a source of nitrogen, sulphate of ammonia in the absence of lime, has acted adversely on cropping throughout, and those plots receiving an annual dressing have gradually become more and more toxic. It became evident during the course of this experiment that though this action is masked to some extent when used in mixtures of complete artificials, nevertheless it is only a matter of time before its baneful effects appear if used continuously. Thus a mixture of sulphate of ammonia and superphosphate had initially a positive effect on cowpeas, though their continued use has turned this into a deleterious one. The superiority of commercial nitrates as a source of nitrogen in complete fertiliser mixtures, either with or without lime, has been fully proved.

Commercial potash manures, and also nitrates, either alone or mixed, were quite ineffective in the early years; when superphosphate was also added however, even without lime, the effect was positive and this continues to the present day.

It is only in the 10th year, that sulphate or nitrate of potash used alone even in the presence of lime have shown any marked effect on cropping, both *dhaincha* and oats responding well in 1921, the former crop *dhaincha* responding even in the absence of lime.

Plots laid down to study the duration of effect of small lime dressings, showed that a dressing of 10 maunds slacked lime per acre had an appreciable effect on oats for ~~some~~ 8 years. At the end of that time the effect was practically nil in the absence of other manuring.

The course of the experiment has also shown that given drainage, thorough cultivation and the incorporation of bulky organic matter, this soil undoubtedly gradually becomes less toxic and will after a few years of such treatment carry through even a crop of oats without the use of any lime. In my opinion however this is no excuse for dispensing with lime, thus hastening matters and improving the soil in the other directions.

15. *Block L.—Ground limestone experiments.*—These were commenced in 1913 and has attained their 9th year in the year under review. The soil was very poor and the land had been newly broken up for laying down the experiments. The scheme consists of 6 plots, each $\frac{1}{2}$ acre in two series of 3 plots each. The first series, section A, is cultivated shallow (3 to 4 inches) with country implements, while the second series section B, is worked deeper (7 to 8 inches) with English implements. This ensures a deeper application of the limestone on section B, the chief objects being to elucidate the effects of incorporating lime with the soil to different depths and to test the value of deep versus shallow cultivation.

The first application of ground limestone was made in 1913 and repeated in 1919 as follows :—

Sections A and B...	{	Plot No. 1	15 maunds limestone
			per acre.
		" " 2	Nil.
		" " 3	30 maunds limestone
			per acre.

For previous cropping results past reports may be consulted. During the year under review this block was green-manured with cowpea during rains and sown with wheat in the cold weather. No manure was applied to either of the crops. In the non-lime plots both the crops practically made no growth after germination. The green-manure crop, which was not weighed, appeared to fare better on the more heavily limed plots and on the whole the crop on all the limed plots might have been called a

fair crop. As regards wheat the following statement of yield speaks for itself :—

	Plot 1 (15 mds. lime area)	Plot 2 (No lime area).	Plot 3 (30 mds. lime area).
1	2	3	4
Section A of shallow cultivation.	65 lbs.	Nil.	147 lbs.
Section B of deep cul- tivation.	37 „	Nil.	148 „

16. *Block G.—Lime Experiment.*—This block contains the oldest lime experiment on the farm. Half the area was limed at the rate of 50 mds. slacked lime per acre some 13 years ago and both sections have been regularly and similarly cropped ever since with the object of determining the effective duration of a single application of lime.

This year this area was cropped with cowpea for green-manure during the rains and oats in the cold weather. The cowpea crop was badly diseased and died off while quite young. As to the oats no crop was obtained from the unlimed area while the limed area gave an yield of 120 lbs. of grain per acre.

17. *Mineral Phosphate Experiments in the cane rotation.—Blocks A, B, D, E.*—An area of about 1 acre in each of the four cane rotation blocks is being dressed every fourth year with flour of phosphate with a view to testing the efficacy of these naturally occurring phosphates.

It is intended to work through two or preferably three complete rotations before generalising. Up to date only one complete rotation on all four blocks has been completed, and the results so far are inconclusive in regard to the value of this form of mineral phosphate for cane; on the contrary it is pronounced on the rape crop and well marked on oats and green crops.

The cane rotation has this year, in view of improved soil conditions, been changed slightly, a crop of maize taking the place of *dhaincha* green crop in the rains of third year. This crop should give further evidence as to the value of the mineral phosphate. Block E was the area to receive phosphate this year; this is the third application, the former two having been given in 1917 and 1918. During the year the green crops and also the

rape on the phosphated areas were markedly better than on the corresponding unphosphated areas.

The results for the oats crop on Block B were as under :—

Phosphated area, 1 acre—1,322 lbs. grain.

Unphosphated „ 1 „ —886 „ „

18. *Fodder crops.*—The experiments with Guinea grass and Rhodes grass on Block A were continued. They were trenched with cowdung between the rows and kept under careful inter-cultivation with the spring-tynd cultivator. The Sudan grass failed to give satisfactory results and was consequently abandoned. Although Rhodes grass gave quite good result during the cold weather months yet Guinea grass proved to be much hardier and gave on the whole far heavier yield than the Rhodes grass. In order to see how they fare under irrigation during the dry and cold months both the crops were irrigated in November with water equal to a rainfall of one inch. There was practically no response from the Guinea grass, with which warmth, therefore, would appear to be the controlling factor. But in the case of Rhodes grass the irrigation gave striking results :—

The following statement gives their comparative results.

—	Area of plots.	Outturn from April to November, 15th.	Outturn from the 15th November to March 1922.		Total outturn.	Outturn per acre.
			Irrigated.	Not irrigated.		
1	2	3	4	5	6	7
	Sq. ft.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Tons.
Guinea grass ...	3,600	57 36	...	...	57 36	25.9
Rhodes grass ...	1,080	5 24	4 23	...	10 7	15.2
	1,080	5 24	Not weighed		...	...
	1,080	5 24	...	2 38	8 22	13.7

The plot of Guinea grass planted out in the rains of 1919, on Block M (area .25 acre) was trenched with cowdung between the rows and given careful inter-cultivation. It yielded 126 maunds 4 seers of green fodder, giving an outturn of $18\frac{2}{3}$ tons per acre, in 10 cuttings taken between the 30th April and the 3rd Novem-

ber 1921. The Rhodes grass on the same block did not give good results and was replaced during the rains of 1921 with Guinea grass which has made good growth since.

Besides these, the area of Guinea grass on Block Q continued to produce good results. The prospects of Guinea grass as a popular fodder grass appear to be quite hopeful. During the year under report 1,236 clumps of it were sold and 100 more supplied free.

19. *Pulse crops*.—"Para pea," a small seeded variety of cowpea, was sown on .2 acre in the kitchen garden area. The crop was badly diseased and only $5\frac{1}{2}$ lbs. of seed was secured.

"Burma bean" was sown on .3 acre in the same block. Though sown somewhat late, the crop did tolerably well and gave an outturn of 137 lbs. seed or 456 lbs. per acre. There is one great disadvantage of this pulse that the pods come out and ripen off gradually; consequently, harvesting is troublesome and takes a long time.

Arhar.—The four varieties of *arhar* tried last year namely Comilla Brown, Comilla White, early and late varieties were grown on Block R. The land being rather poor the outturn was very low and consequently no reliance could be placed on the results, the highest outturn being only 108 lbs. per acre and the lowest about 16 lbs. per acre.

20. *Extension area*.—Block M.—After two years of cane this was under *dhaincha* for green manuring in the rains and had oats in the cold weather. The crop on the limed area looked, as usual, much better than that on the unlimed plot, their outturns were quite striking, the former giving an outturn of 574 lbs. and the latter 107 lbs. per acre.

Block N.—The eastern portion of this block was under B147 plant cane for the study of sugar contents in different stages of ripening off and after. The rest was under plant canes, mostly Striped Mauritius, for distribution, and had been sown with cowpea and *dhaincha* between the rows of canes with a view to see if they can control the weeds or have any green manuring value. While waiting for harvesting the canes were very much damaged by parrots and it was not worth the while to weigh the crop, consequently, the experiment led to no results.

Block O.—The eastern portion was under ratoon and the western under plant canes specially selected and treated for the supply of planting materials. Heavy manuring was purposely

avoided as experience has shown that for the production of better planting materials lighter doses of manures are more suitable.

Block P.—This block was under cowpea for green manuring during the rains, kept fallow during the cold weather and subsequently planted out with canes for planting material for 1923-24.

Block Q.—This block continued under Guinea grass with very satisfactory results.

Block R.—Was under *arhar* of 4 different varieties. The crops were so poor that it is not worth considering them for any reliable information as to effect of the manurial treatment with the water hyacinth ash and the Basic slag.

21. *Other crops*—*Block H.*—Was green manured with *dhaincha* during the rains and was sown in early September with cowpea for seeds. The outturn of cowpea was $3\frac{1}{2}$ maunds per acre; the yield was low on account of late sowing and unfavourable weather.

22. *Orchard.*—Amongst the fruit trees in the orchard litchis, *sapotas* and pineapples continued to fruit well. But the litchi mites grew from bad to worse. Mangoes again blossomed profusely but all the fruits dropped before ripening. The orange trees are dying out gradually.

The pineapple suckers continued in demand and 550 of them were supplied free and 112 sold.

23. *Building Machinery, etc.*—The farm is provided with a godown, combined office and rest house, manager's bungalow, clerk and apprentices' quarters, coolie huts, cattle shed, Dutch barn, etc., and is enclosed by an "Ideal" wire fencing.

A Hornsby oil engine and a crushing mill capable of dealing with one ton of cane per hour was installed in 1911. An winnowing machine has last year been added to the list of labour saving devices and improved implements which consisted of disc plough, chain harrow, disc harrow, turnwrest ploughs, Meston ploughs, springtyned cultivators, lever harrows, roller, etc.

During the year under report the quarters of the farm clerk were improved by an extension of a portico at a cost of Rs. 250. New semi-permanent quarters for the Assistant Farm Manager were constructed at the expenditure of Rs. 2,000. One *kutcha* *rejas* shed and a second *gur*-boiling shed were erected at the cost of Rs. 186 and Rs. 217, respectively. Besides, a rotary hand pump was set up to facilitate the supply of drinking water.

24. *Receipts and expenditure.*—The following statement shows the receipts and expenditure for the year under report :—

	Rs.	a.	p.
Receipts—			
Amount actually credited into Treasury	3,614	5	0
Value of seeds, sugarcane setts, plants, etc., supplied free for demonstration, etc.	295	9	0
Value of stock in hand—			
Gur 224 maunds at Rs. 6-8	1,456	0	0
Paddy 11 maunds 26 seers at Rs. 3	34	15	0
Cowpea 3 maunds 6 seers at Rs. 10	31	8	0
Oats 57 maunds at Rs. 7	399	0	0
Wheat 4 maunds 35 seers at Rs. 7	34	2	0
Burma bean and others 1 maund 30 seers	6	0	0
Total	5,871	7	0
Less value of farm produce of previous year sold during the year...	1,491	13	6
Nett receipts	4,379	9	6
Expenditure—			
Petty construction	3,268	3	10
Purchase of implements, etc.	725	9	0
Purchase of seed, manures and plants	1,187	12	6
Petty repairs	607	8	0
Feed of cattle	576	3	0
Establishment	3,986	0	0
Stipend to apprentices	1,089	13	5
Wages of labourers	3,979	5	9
Purchase and repair of furniture	5	3	0
Service postage and telegrams	25	0	0
Miscellaneous and unspecified charges	1,562	1	9
Total	17,030	12	3
Add value of seeds supplied by the seed Depôt, Gauhati	155	15	0
Total	17,186	11	3

25. *Establishment*.—The farm staff consists of a Manager on Rs. 100—10—200, an Assistant Farm Manager on Rs. 60—6—120, a clerk on Rs. 30— $\frac{4}{2}$ —50 and a peon on 11— $\frac{1}{5}$ —15.

There is provision for the training of eight apprentices with stipends of Rs. 12 in the first year and Rs. 15 in the second year. During the year under report two apprentices successfully completed their training, one of them was appointed as an Agricultural Demonstrator and the other is being temporarily employed in the Department. One apprentice was disqualified towards the close of his training and another dismissed for insubordination. Four new apprentices were admitted during the year, one of them did not stick. Thus at the end of the year there were only six apprentices at the Farm.

26. *Inspection*.—His Excellency the Governor of Assam paid a kind visit to the Farm in the rains and the Hon'ble Minister in charge of Agriculture, in the cold weather. The Director of Land Records and Agriculture, Assam, inspected in July, 1921. Maulavi Rukunuddin Ahmed, B.L., M.L.C., was good enough to pay a visit in January.

27. *Acknowledgment*.—Mr. A. A. Meggitt, Agricultural Chemist, Assam, was kind enough to write the paragraphs on sugarcane experiments and soil investigations, etc. I am indebted to him for this.

JORHAT ;

The 22nd May 1922.

L. BARTHAKUR,

Deputy Director of Agriculture, Assam Valley.

REPORT OF THE UPPER SHILLONG AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING The 31ST MARCH, 1922.

1. The Upper Shillong Agricultural Station was established in 1897. It is situated on the Shillong-Cherrapunjee road, $5\frac{1}{2}$ miles from the town of Shillong, and occupies the site of the old Model Farm which ceased to exist in 1879. The elevation of the place is 5,900 feet, *i.e.*, about 900 feet higher than Shillong town. The total area of the Farm is 363.67 acres, of which a large portion is occupied by pine forest. Most of the cultivated and culturable land lies in a long narrow valley. The bottom of the valley was formerly a marsh which was of very little value for any purpose; it has now been converted into firm pasture ground by deepening the stream which drains the valley, and opening side drains into it. The effect of this work is now showing in the considerably improved herbage which is produced.

The soil of the higher lands is a coarse reddish loam of very loose texture which can be worked with great ease. The subsoil is of a pronounced reddish colour and of great depth. At the bottom of the valley a different type of soil is found, namely, clay or clayey loam, extremely rich in organic matter. Having long been under a thick growth of grass, the upper portion of the soil is a matted mass of half decayed grass roots. The soil of the Farm is extremely poor and very little can be grown on it without the help of manure.

The greater part of the Station suffers from the disadvantage of the exposed situation. The place is colder and more windy than Shillong; frosts are of very common occurrence and are more severe than in the town. During the winter the growth of vegetation is entirely suspended.

2. The main objects for which the Station is maintained are :—(1) the trial and introduction of new varieties of potato which is now the most important crop grown on the plateau of the Khasi Hills (2) the breeding of improved strains of milch cows and breeding bulls suitable for the tract, and (3) the cultivation of fodder crops for their upkeep. Fodder experiments have been tried from time to time, but having proved abortive, they have, one after another, dropped out of the programme of the Farm. The two crops now grown at the Farm for fodder are Maize and *Bajra*.

3. The following table gives the rainfall for the period under report :—

Weather.

Rainfall.

Month.				Actual 1921-22.	Normal.	Number of rainy days in 1921-22.
1				2	3	4
April	...	...	...	6.52	5.13	17
May	...	...	...	9.93	10.54	14
June	...	...	...	18.43	20.05	22
July	...	...	...	29.88	17.26	23
August	...	...	...	14.39	15.06	22
September	...	...	...	8.51	10.40	14
October	...	...	...	3.90	7.46	12
November	...	...	...	0.66	1.32	2
December	...	...	...	0.31	0.20	1
January	...	...	...	0.52	0.35	1
February	...	...	...	0.32	1.16	2
March	...	...	...	1.52	2.17	2
Total				94.89	91.10	132

The rainfall was about normal; but the heavy and frequent downpour from May to July considerably damaged the potato crop and increased potato blight. There was a severe hailstorm in November which totally destroyed the ripe paddy grains and did considerable damage to the winter potato.

4. The work done during the year consisted of :—

Summary of Work.

- (1) Trials of different varieties of potatoes.
- (2) Manurial and Spraying experiments
with potatoes.
- (3) Growing potatoes for seed.
- (4) Growing of fodder crops and miscellaneous.
- (5) Cattle breeding.
- (6) Distribution of seeds, implements, etc.

5. The total number of varieties under trial in 1921 was twenty-four, including the six new varieties imported last year from England. Trial of varieties of potato. All these varieties were planted in duplicate plots of $\frac{1}{4}$ th acre each. They were planted in March and harvested in August; winter seed was used in each case. The land was manured with 11 tons of cowdung and 823 lbs. of rape cake per acre, and the crop was sprayed with Bordeaux mixture at the rate of 340 gallons per acre applied in two equal doses.

The outturns of the varieties for the last fourteen years are given below.

Statement showing the average yield per acre on duplicate plots for the last 14 years—concl'd.

Variety.	Average of last 14 years.																Remarks.
	1021.	1920.	1919.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
16. Sterling Castle (1919)	...	3.01	2.20	...	...	...	...	...	...	...	...	...	...	...	2.60	2 years' average.
17. Edinburgh Castle (..)	...	1.50	1.28	...	...	...	...	...	...	...	...	...	...	...	1.39	" "
18. Arran Chief (..)	...	1.32	.80	...	...	...	...	...	...	...	...	...	...	...	1.06	" "
19. King Edward VII (1921)	...	3.65	...	...	...	...	...	...	...	...	...	...	...	...	...	1st year.
20. British Queen (1921)	...	1.87	...	...	...	...	...	...	...	...	...	...	...	...	...	" "
21. Great Scott (1921)	...	4.03	...	...	...	...	...	...	...	...	...	...	...	...	...	" "
22. Arran Chief, (..)	4.14	...	...	...	...	...	...	...	...	...	...	...	...	...	" "
23. Ally .. (..)	...	2.02	...	...	...	...	...	...	...	...	...	...	...	...	...	" "
24. Up-to-date (..)	2.40	...	...	...	...	...	...	...	...	...	...	...	...	...	" "

Of the above, the following varieties have been discarded :—

Windsor Castle, 1912.

Up-to-date, 1915.

Sterling Castle, 1915.

Edinburgh Castle, 1915.

The trials are being continued with the other 20 varieties. The potatoes grown from seeds obtained in 1916 through Mr. Ferguson have broken up into a large number of types, of which 95 have been kept. The flower-balls grown similarly have produced 41 types. All these are being grown for further trials on a field scale. The inferior types will be weeded out and only a selected few will then be grown for comparison.

As in the former years, 50 tubers of each variety were selected at random and examined for signs of disease. The following table gives the result of examination during the last twelve years :—

Varieties.	Number of diseased tubers out of 50 examined.												
	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.	
1	2	3	4	5	6	7	8	9	10	11	12	13	
King of Potatoes ...	12	nil	nil	nil	1	5	3	nil	2	7	22	5	
King Edward VII, 1921	7	
British Queen, 1909 ...	12	nil	6	6	2	8	2	...	1	9	16	...	
Up-to-date, 1921	3	
Magnum Bonum, 1912	6	6	2	3	1	5	3	3	22	4	
Windsor Castle, 1912	4	3	2	10	1	...	...	1	13	9	
British Queen, 1912	4	4	3	6	1	1	3	4	7	7	
British Queen, 1921	6	
Imperator, 1912	22	3	3	4	6	...	2	9	12	6	
Sterling Castle, 1915	10	...	5	9	10	6	
Sterling Castle, 1919	8	
Epicure, 1915	5	1	6	3	2	...	
Magnum Bonum, 1915	5	1	3	2	8	3	
Dover Castle, 1915	4	1	4	2	6	6	
Up-to-date, 1915	1	1	4	1	12	1	
King of Potatoes, 1916	1	...	3	17	2	
Windsor Castle, 1916	2	3	1	6	18	1	

Varieties.	Number of diseased tubers out of 50 examined.											
	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.
1	2	3	4	5	6	7	8	9	10	11	12	13
Edinburgh Castle, 1915	3	...	...	3	2	6
Edinburgh Castle, 1919	9
Ally	1
Balmoral Castle	5	3	2	7	3	4
Arran Chief, 1915	2	2	2	9	4
Arran Chief, 1921	2
Great Scott, 1921	4

A sample of fungicide (Burgundi Mixture) was sent by a Calcutta Firm for trial. The mixture was prepared in accordance with the instructions given by the Firm and was tried against Bordeaux Mixture. Duplicate plots of two varieties of potatoes of $\frac{1}{4}$ th acre each were sprayed twice by each of the above mixtures. The results are given below. They confirm the results obtained on a small scale last year. In addition to proving less effective than Bordeaux Mixture, Burgundi Mixture was more expensive.

Results of the Spraying Experiments in tons per acre.

Treatment.	Inoperator.	Windsor castle.	Average of both series.
Spraying with Burgundy Mixture.	3.79	2.17	2.98
Spraying with Bordeaux Mixture.	4.00	3.28	3.64
Unsprayed	2.51	2.69	2.60

Potato Manurial Experiment.—An experiment designed to shed some light on the respective manurial values of rape cake and bonemeal for the potato crop, is being carried out since 1916. This experiment was put down in duplicates in two series, one with King of Potatoes and the other with Magnum Bonum. The seed-rate was 987 pounds per acre. The manures used and the

yields obtained in 1921 are shown in the accompanying table:—

Manure used per acre.	Cowdung 5.5 tons.	Cowdung 5.5 tons, rape cake 823 lbs.	Rape cake 823 lbs.	Bonemeal 823 lbs.	Cowdung 5.5 tons, bonemeal 823 lbs.	Rape cake 823 lbs., bonemeal 823 lbs.	Lime 1.10 tons.	Cowdung 5.5 tons, lime 1.10 tons.	Cowdung 5.5 tons, rape cake 646 lbs.	Cowdung 5.5 tons, rape cake 823 lbs, lime 1.10 tons.	Cowdung 5.5 tons, bonemeal 823 lbs., lime 1.10 tons.
1	2	3	4	5	6	7	8	9	10	11	12
Imperator ...	2.82	4.33	1.72	1.94	3.71	3.01	.33	4.02	5.21	3.12	4.44
Magnum Bonum ...	3.23	3.85	2.73	2.73	4.44	2.73	1.06	3.49	3.26	3.89	2.82
Average yield per acre.	3.07	4.09	2.25	2.33	4.07	2.90	.69	3.75	4.23	3.50	3.63

Bonemeal and rape cake were used not because they are considered the most suitable for the potato crop, but because they are practically the only manures, other than cowdung, which are available in Khasi Hills. The experiment is being repeated during the present year.

6. It is the custom among the Khasi cultivators to grow an autumn crop of potato, principally for the purpose of using the produce for seed for the following summer crop. This custom has been followed at the Farm for some years, but owing to the exposed situation of the Farm it has been found that the yield of the autumn grown crop is so small as to make seed produced in this way extremely expensive. With the object of finding a cheaper source of seed, the method of boxing summer seeds was tried. The method consists of placing the seed potatoes in small shallow boxes and storing them in a lighted but not too airy shed. Under conditions of moderate temperature and moisture the setts keep satisfactorily and produce short well-formed sprouts which grow at a slow rate. These setts can be planted out from the boxes at the ordinary planting season and are then likely to grow rapidly.

During the last four years, potatoes from the summer crop were placed in sprouting boxes and kept there during the subsequent cold weather. In the spring, these sprouted summer setts were planted alongside the unsprouted winter setts. The size and weights used per acre were approximately the same. Similar conditions of cultivation, manuring and spraying, were observed.

for both plots and as the experiment was tried with six of the main varieties, the result may be taken as fairly conclusive. The average of the yields obtained were as follows:—

Year.	Weight in tons per acre.	
	Summer.	Winter.
1	2	3
1918	4.45	4.41
1919	7.26	5.58
1920	6.25	5.01
1921	3.41	2.74

A record of weights of the seeds kept showed a rotting and drilage of 26.17 and 29.47 per cent. respectively, in the case of Up-to-date and Windsor Castle. Even allowing for this, summer seeds appear to be cheaper. The results so far are satisfactory and the experiment will be continued, a record of the weight before and after storage being kept. The produce of the summer seeds is, however, suspected to be more susceptible to diseases than the produce of winter seeds. Careful observation will be made on these points.

7. The six varieties of potato which have given the best results so far, were grown during 1921 for the production of seeds. The crop was planted in March and harvested in August. The total area planted was 7.39 acres. The manure used was, as in the previous year, 5.5 tons of cowdung and 823 pounds of rape cake per acre. The crop was sprayed once with Bordeaux Mixture at the rate of 120 gallons per acre. The outturns were as follows:—

Variety.	Area in acres.	Total yield in tons.
King of Potatoes	.95	1.51
Magnum Bonum	1.67	6.72
Up-to-date	.82	2.80
Windsor Castle	1.15	2.04
British Queen	.95	2.24
Imperator	1.85	3.30
Total	7.39	21.01

About 12 acres were planted in March last with the same 6 varieties forced. As the demand for seed potato has greatly increased and the quantity of manure available at the Farm strictly limited, a small area was grown at the Farm according to the *Jhum* system, through outside cultivators. The cultivators provided the labour, the Farm provided the land and the seed, and received back one and a half times the seeds supplied. 2.29 tons were supplied and 3.44 tons received back during the year. The policy has been to gradually reduce the *Jhum* area at the Farm, and the practice has been entirely discontinued during the current year.

The total quantity of seed potatoes available at the Farm was 30.80 tons, including 3.44 tons of *Jhum* grown potatoes. This was disposed of as follows:—

Planted at the Farm	...	...	13.80 tons.
Issued to cultivators on the return system			13.05 "
Sold to cultivators	...	...	2.18 "
Demonstration	...	...	0.07 "
Rottage and driage	...	...	1.70 "
Total	...		<hr/> 30.80 " <hr/>

The seeds were disposed of as soon as possible; only the amount actually required for Farm use was stored. Hence the comparatively low percentage of rottage and driage.

Reference was made in the last year's report about the potato disease which was causing considerable damage to the potato crop at the Farm as well as throughout the hills. The new seed imported last year direct from England has produced a fresh stock which will be propagated for seed. Investigations are also being conducted to find out the most effective means of combating the disease.

8. *Straw berries*.—In September 1916, a plot of $\frac{1}{50}$ th acre was planted with two varieties of straw berries obtained from the Fruit Experiment Station at Shillong. These plants grew well and in October 1917 another $\frac{1}{10}$ th acre was planted with the suckers of those two varieties. With the plot planted in 1912, the total area at present is about .17 acre. About 14 lbs. of fruit have been picked and sold during the year, the return from them being Rs. 10-8.

Other fruits.—A few of the other trees on the Farm bore fruits which were sold and realised the following prices.—

				Rs.	a.	p.
Apples	...	...	...	11	9	6
Peaches	...	...	...	6	4	0
Ches:nut	...	...	...	47	8	0
Plums	...	...	...	5	10	0
Total				70	15	6

Fodder crops. 9. The following fodder crops were grown during the year :—

Name of crops.	Area sown.	Cost of cultivation.	Outturn of green fodder.
1	2	3	
	Acres.	Rs. a. p.	Tons.
Maize ...	17.3	...	83.43
Job's Tears (jhum area) ...	5.5	...	5.43
Total ...	22.8	789 10 0	88.86

The maize crop gave a fair yield. The whole of this fodder was made into silage and 41.69 tons or 91.20 per cent. was recovered as ensilage of good quality. The total cost of silage was Rs. 950-5-6 made up of Rs. 789-10-6 for cultivation and Rs. 170-11 for carrying, chopping and packing in the silo. The cost per ton of silage was Rs. 23-5-6 as compared with Rs. 23-1-9 in the previous year.

Raishan (*Paspalum Sanguinale*) has been successfully grown as a hay crop since 1912 and has proved a valuable winter food for the cattle. It was grown on an area of 48.57 acres and the produce was made into hay and fed to the cattle during the winter months.

A total amount of about 20.60 tons of hay was fed during the year. The cost was Rs. 472-15-1 or a little over Rs. 22-15-3 per ton of hay as compared with Rs. 30-13 in 1921. The quality of the fodder was good and eaten greedily by the cattle.

10. The half-Patna cattle have proved remarkably well-adapted to the climate of the Khasi Hills. Cattle Breeding. In respect of milking capacity, these cattle stand head and shoulders above any cattle on this side of India. The demand for the cows continues keen, but is still practically confined to a few people about Shillong, who are experienced in the care of cattle. The breeding bulls are generally in great demand and are disposed of as fast as they reach the age of three years when they are considered fit for use. The demand, however, is mostly from Tea Planters from the plains. The policy of keeping only two distinct herds, one of pure Patna and the other of mixed Patna and Bhutia, described in the Report of 1920, is already showing promising results. The new progeny is showing distinct improvement over the old mixed lot.

Five young Patna breeding bulls, one old Montgomery bull and one heifer, were sold during the year. Three cows died on account of old age and debility and five heifers died through disease. One young bull was lost and another died from an unknown disease.

The cost of maintaining the herd is becoming higher owing to the rise in price of all food stuffs. The cost during the year amounted to Rs. 5,812-2-9. The income from the sale of milk was Rs. 2,816-0-4 and from the sale of cattle Rs. 215.

The total yield of milk during the year amounted to 4,153.4 gallons as compared with 3,969 gallons of last year, out of which 229.3 gallons were fed to calves and the remainder sold at the rate of 13 lbs. for a rupee. The price has been raised to 10 lbs. from 1st March 1922.

The following statement shows the number of animals on the Farm on the 31st March 1922 :—

Statement showing the number of cattle on the Farm on 31st March 1922.

	P. B. P.	Moolany.	Mony, Patna.	Motig. P. B.	M. P. B. P.	M. P. B. P. P.	M. Bhutia.	Patna.	Bhulia.	P. B.	P. B. B.	P. B. P. P.	P. B. P. P. P.	Patna and Khadia (K).	M. P. P.	Total on 31st March 1922.	Total on 31st March 1921.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Breeding* bulls	12	...	...	...	...	...	...	...	3	3	
Bulls 5 years and above	
Bulls 1 to 3 years	1	...	2	1	...	...	...	7	...	...	...	1	...	...	1	13	6	
Bull under 1 year	8	...	...	...	6	2	...	...	14	14	
Heifers 2 to 3 years	1	...	...	...	...	...	...	1	...	...	...	...	...	2	3	
Heifers 1 to 2 years	3	...	...	...	4	1	...	...	8	2	
Heifers under 1 year	5	...	...	...	4	1	...	...	10	11	
Cows	4	...	...	...	...	14	...	1	8	3	...	...	...	30	30	
Total on the 31st March 1922.	1	...	7	1	...	...	...	39	...	1	9	16	4	...	1	70	...	
Total on the 31st March 1921.	...	1	8	2	3	...	...	29	...	1	12	10	1	...	2	...	69	

Besides* these, there are 2 cart bullocks and 12 plough bullocks.

11. The following seeds and plants were sold from the Farm

Distribution of seeds and plants to the cultivators during the year :—

	Tons.	Number.
1	2	3
Seed potatoes	2.18	6
Pear grafts	...	50
Strawberry suckers	...	...

13.05 tons of seed potatoes were also distributed to cultivators outside on the return system; 8.58 tons of seed potatoes were purchased from *Jhum*-growers and sent to the plains.

12. U Herick Singh continued as Farm Manager and U Shetro Mohon Jyrwa as Farm Clerk throughout the year under report.

13. One D. Llewellyn Mikir, an apprentice from North Cachar, was transferred to Karimganj after working at the Farm for one year and one month. U. Woolancton was taken in his place. A Lushai apprentice has been under training since December 1920, and another Khasi apprentice has been under training since December 1921 with a view to his being sent to an Agricultural College for higher training.

14. The total receipts and expenditure of the Farm for the year are shown below :—

Receipts—			Rs.	a.	p.
Sale of milk ...	...	...	2,816	0	4
Sale of cattle ...	...	...	215	0	0
Sale of potatoes ...	...	...	364	9	1
Miscellaneous ...	...	...	158	11	6
Price of 3.12 tons of potatoes supplied for demonstration after deducting the amount paid ...	...	...	425	0	0
Total			3,979	4	11
Expenditure—					
Capital expenditure ...	...	...	.....
Purchase of cattle ...	...	...	68	0	0
Petty constructions ...	...	...	2,079	14	6
Total			2,147	14	6

Recurring expenditure—

			Rs.	a.	p.
Establishment	...	...	3,100	0	0
Feed of cattle	...	...	4,566	14	3
Seeds, plants and manures	...	...	1,377	10	4
Wages of labourers	...	...	4,671	7	0
Petty repairs ...	...	...	787	1	6
Purchase and repair of furniture	...	...	39	15	9
Service postage and telegrams	...	...	40	11	6
Unspecified charges	...	...	724	13	6
Medicine	...	...	2	8	0
Total			15,311	1	10
Grand total			17,459	0	4

Dated, Sylhet,
The 5th May, 1922.

J. N. CHAKRAVARTY,
Deputy Director of Agriculture, Surma Valley
and Hill Districts.

REPORT OF THE KARIMGANJ AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING THE 31st MARCH 1922.

1. This station was established in January 1914. It is situated on the Sylhet-Silchar road, $3\frac{1}{2}$ miles to the west of the subdivisional town of Karimganj, which lies on the Assam-Bengal Railway. The total area of the Farm is a little under 80 acres. Leaving out a compact block of 8 acres, set apart for the Farmstead and staff quarters, and about 12 acres covered by roads, drains and *ails*, the net area available for cultivation is about 60 acres. The Farm is primarily a rice station, and out of 60 acres of arable area 55 acres are fit for paddy only. On the remaining portion, jute and rabi crops can be grown only under favourable conditions. Out of this, 1.25 acre has been raised and made fit for rabi crops during the last two years.

2. The Farm lies close to the Longai river which occasionally rises in high flood and lays the country all round under water. This liability to floods is characteristic of rice lands in the Sylhet district. The soil of the greater portion of the Farm is a deep alluvial clay of fine texture, which becomes very stiff on drying, forming into big clods which are difficult to bring into fine tilth. In the higher portions, the soil is somewhat lighter in character and may be described as a medium loam.

The soil was analysed by the Agricultural Chemist and the results are shown below, with his remarks:—

	Laboratory No. 194, Blocks B and F surface soil per cent.	Laboratory No. 195, Block C surface soil per cent.
1	2	3
A.—Soluble in 26 per cent. Hydrochloric Acid with 48 hours' digestion at 100°.	...	...
Phosphoric Acid (P_2O_5)	0.082	0.089
Potash (K_2O)	0.743	0.897
Lime (CaO)	0.243	0.442
Magnesia (MgO)	0.806	0.928

Recurring expenditure—

			Rs.	a.	p.
Establishment	3,100	0	0
Feed of cattle	4,566	14	3
Seeds, plants and manures	1,377	10	4
Wages of labourers	4,671	7	0
Petty repairs	787	1	6
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Lime (CaO)	0.243	0.442
Magnesia (MgO)	0.806	0.928

	Laboratory No. 191, Blocks B and F surface soil per cent.	Laboratory No. 195, Block C surface soil per cent.
1	2	3
B.—Available, i.e., soluble in 1 per cent.		
Citric acid with 7 days' digestion (Dyer's Method).		
Phosphoric acid ($P_2 O_5$) ...	0.006	0.008
Potash ($K_2 O$) ...	0.004	0.005
C.—Moisture in air-dry soil ...		
Loss on ignition (organic matter and combined water).	3.69	4.76
Nitrogen ...	0.089	0.121
Calcium Carbonate ...	Trace	Trace
Reaction ...	Acid	Acid

N.B.—Percentages are expressed on air-dry materials.

"A. (a) Lime is deficient and the ratio of magnesia to lime is high; this is probably not of so great importance from the point of view of paddy cultivation as it would be in the case of many other crops. Experiments on small dressing of 5 or even 10 maunds lime per acre might perhaps give results in combination with green-manuring and the use of phosphate.

(b) Both total and available phosphate are on the low side; experiments using basic slag, superphosphate and bone dust on a basis of a given quantity of phosphoric acid per acre might be tried.

(c) Total potash is very high and available supplies would appear to be on the border land. Small dressing of potash may show results in the case of paddy.

(d) Nitrogen is quite fair in sample number 195 and average in 191. I am of opinion, however, judging by the soil's behaviour in the laboratory, that nitrogen is not in a very available

condition and a good response might follow moderate nitrogen dressings.

(e) An increase in the humus content would seem desirable. Green-manuring and the regular use of cow-dung as manure would help matters. For paddy, however, I would not advise excessive dressing of cow-dung."

3. Considerable additions and improvements were made during the year in the equipment of the Farm. Construction and repairs. Owing to the large increase in the number of varieties of rice under experiment, and the initiation of Laboratory work by the Economic Botanist, accommodation in the present office and godown proved quite inadequate, and a small extension has been added to the new godown for purely Botanical work. It has also been decided to post a Botanical Assistant permanently at the Farm, and quarters for him are under construction.

A second Apprentices' quarters, with accommodation for 4, was erected during the year. The ekra walls of the Farm Manager's quarters, which were in a very dilapidated condition, have been replaced with bricks and the whole building has been thoroughly repaired and improved. This is expected to effect considerable savings in the recurring expenditure for repairs.

Two heavy floods in June and September caused considerable damage to the Farm roads and kutchra bridges. Thanks, however, to the precautions taken during previous years in raising the *bunds* of the experimental area, no damage was caused to the experimental crops of the Farm, although most of the paddy fields round the Farm were severely damaged. The worst portions of the roads have been considerably raised, but a good deal yet remains to be done in this direction. This year's experience has proved the imperative necessity of protecting the whole Farm from risks of damages by flood. This work has been started but could not be finished for want of funds. It is expected to be completed during the current year. A third Apprentices' quarters, a few semi-permanent cooly sheds and a covered threshing floor are all that are now needed to complete the equipment of the Farm for some time to come.

4. There was a severe outbreak of foot-and-mouth disease among the Farm bullocks in June, but all the animals recovered. Eight old unserviceable bullocks were disposed of during the year, and nine new animals were purchased, bringing the total number of animals on the Farm to thirty.

5. *Weather*.—The following table gives the actual and normal rainfall for the year :—

Months.					Actual.	Number of rainy days.	Normal.
1					2	3	4
April	1921	...	...	...	12.98	16	14.94
May	"	...	...	...	11.52	14	20.70
June	"	...	...	...	37.86	24	24.38
July	"	...	...	...	21.91	22	26.45
August	"	...	...	...	15.38	22	21.34
September	"	...	...	...	23.79	19	18.19
October	"	...	...	...	10.54	11	7.89
November	"	...	...	...	.19	1	1.36
December	"	...	...	...	...	...	1.15
January	1922	...	...	...	.03	...	.25
February	"	...	...	...	.03	"	2.08
March	"	...	...	...	4.17	8	7.63
Total					138.40	137	146.34

The season was unfavourable throughout the year for all crops. Frequent rainfall in April and May retarded the sowing of Jute and *Aus* paddy. There was a heavy flood in the early part of June followed by another flood in September (some-what similar to that which absolutely destroyed the paddy crop of the Farm in 1915). These two floods almost totally destroyed the paddy crop in the surrounding locality. As already stated,

no damage was caused to the experimental plots. This year's experience showed conclusively, however, the urgent necessity of similarly protecting the other areas, as the experiments are extended.

As the Farm depends on the cultivators of the adjoining villages for its supply of labour, it was found very difficult to obtain enough labour from July to October, as the people were very busy replanting their own areas. As already noted, there was also a serious outbreak of foot-and-mouth disease among the Farm cattle immediately after the last flood. Owing to a combination of the above circumstances the Farm operations were very much delayed, and although the whole Farm was transplanted the sowing was very late and the outturn obtained very poor.

With the exception of a small plot of peas which was irrigated, Rabi crops also failed owing to the continuous drought in December, January and February, during which there was a rainfall of only .06 inches against a normal of 3.48 inches.

6. As befits an Experimental Station situated in such an extensive rice growing district, attention is devoted mainly to effect improvement of this crop, both by breeding and selection and also by manuring. Minor experiments are also carried on with Jute, Potato, Sugarcane and a few Rabi crops.

7. The experiments were originally started in 1914, after a consultation between Mr. A. G. Birt, Deputy Director of Agriculture, Mr. G. P. Hector, Economic Botanist to the Government of Bengal, and Rai Bahadur Bhupal Chandra Basu, Special Officer of Agriculture. The work has been largely extended during the last few years, and during the year under report selection work has been carried out with 158 types of *Aus*, 176 types of *Sail*, 55 types of *Asra* and 343 types of *Aman*. The *Asra* and *Aman* varieties are being grown mainly for observation. Up till last year, the breeding and selection work was being carried out by the Deputy Director of Agriculture and the Farm staff with the advice of the Economic Botanist to the Government of Bengal. The work has now been taken up by our own Economic Botanist, and a detailed information of the methods followed will be found in his report. Only a general summary of the results obtained are given below :—

Aus.—The *Aus* has been divided into three sub-classes according to the method of cultivation and their growing period—*Dumai*, *Murali* and Transplanted *Aus*. Out of the ten types of

Dumai, three selected varieties were tested for comparison with the following results :—

$D\frac{135}{4}$ AS STANDARD.

Name of variety.	Average yield in oz. per 100 plants.		Increase over the standard variety (average).
	1919.	1920.	
1	2	3	4
$D\frac{134}{3}$	10.65	10.16	.68
$D\frac{135}{4}$	9.82	9.62	
$D\frac{136}{5}$	10.97	8.36	1.12
$D\frac{137}{6}$	9.58	7.50	
$D\frac{138}{7}$ ... ..	...	12.18	.43
$D\frac{139}{8}$ ... ..	...	11.75	

$D\frac{138}{6}$ STANDARD.

Name of variety.	Average yield in oz. per 100 plants (1921).
1	2
$D\frac{134}{3}$	4.82
$D\frac{135}{4}$	4.79
$D\frac{136}{5}$	5.26
$D\frac{137}{6}$	4.94
$D\frac{138}{7}$	5.89
$D\frac{139}{8}$	6.15

Ans.—Out of 50 types of *Murali*, five were grown for comparison with $\frac{36}{30}$ as standard and gave the following results :—

Name of variety.	Average yield in oz. per 100 plants.			Increase over the standard variety (average).
	1921.	1920.	1919.	
1	2	3	4	5
M $\frac{36}{14}$	7.26	10.04	8.98	.18
M $\frac{36}{30}$	6.56	10.37	8.79	
M $\frac{36}{10}$	7.22	9.58	9.87	.17
M $\frac{36}{30}$	6.30	10.30	9.51	
M $\frac{36}{4}$	6.35	...	...	1.05
M $\frac{36}{30}$	5.30	...	...
M $\frac{36}{30}$	5.85	9.66	10.34	—12
M $\frac{36}{30}$	5.65	9.83	10.75	
Kataktara	5.25	9.13	8.74	—68
M $\frac{36}{30}$	6.90	9.90	8.38	

M $\frac{36}{30}$ has not come out as well as in the previous year. Small packets of M $\frac{36}{30}$ were distributed to selected cultivators in 1921 and proved superior to local varieties in most localities. Forty maunds have been sent out for seed during the present season. These experiments will be continued.

Kataktara and M $\frac{36}{30}$ were tested against a local *Murali*, and D $\frac{13}{3}$ against a local *Dumai* on a field scale. All the plots were badly damaged by rice bugs and accurate outturns could not be recorded. The tests will be repeated during the coming season.

Sail.—Work with *Sail* varieties has been going on continuously since 1917. Up till 1920, seven selected farm varieties were tested against *Indra Sail*, a Dacca selection, with results reported last year. Generally *Indra Sail*, *George Sail* and *Lati Sail* proved superior to the other varieties. These three varieties were grown very extensively throughout the Surma Valley during the last three years, and have established their superiority over the local varieties in most of the localities where tried. 428 maunds of these three are being distributed from the Farm as seed during the coming season. The suitability of the three varieties depend partly on the water level of the fields, *Lati Sail* doing best on higher land and *George Sail* on low land.

During last year 8 varieties were tested against *Lati Sail*, but unfortunately four of these were very badly damaged by fungus attacks, and the results of the other four varieties are given below :—

Name of variety.	Average yield of 100 plants (in oz).
1	2
<i>Prosad bhog</i>	56.18
<i>Lati Sail</i>	63.15
<i>Motonga</i>	58.14
<i>Lati Sail</i>	59.63
King's own	59.22
<i>Lati Sail</i>	37.14
<i>George Sail</i> $\frac{1}{2}$	64.23
<i>Lati Sail</i>	69.93

Lati Sail appears to have done best, but one variety *Motonga*, has come a very close second:

The three varieties, *Indra Sail*, *George Sail* and *Lati Sail* were tested on a field scale against a local variety, *Chapra Sail*. The two varieties were grown on two halves of an $\frac{1}{8}$ acre plot, the experiments being replicated five times. The results are given below :—

Name of variety.	Outturn per acre in pounds.	Excess over the local variety.
1	2	3
<i>Indra Sail</i>	2,690	246
<i>Chapra Sail</i>	2,444	
<i>George Sail</i>	3,137	737
<i>Chapra Sail</i>	2,400	
<i>Lati Sail</i>	2,900	327
<i>Chapra Sail</i>	2,573	

The superiority of all the three selected varieties is quite evident.

8. The following manurial experiments were carried out

Minor Experiments. with paddy :—

- (a) Bonemeal as manure for doubled-cropped land.
- (b) Green-manuring with *Dhaincha* for *Sail* paddy, singly and in conjunction with bonemeal.
- (c) Bonemeal and Oilcake.
- (d) Fish manure.

In addition to the above, experiments were carried out with Jute, Sugarcane, Potatoes and Pulses.

9. Paddy Manurial Experiments—

(a) Bonemeal as manure for doubled-cropped land.

The experiment was started in 1915 with the following manurial applications :—

- (1) Bonemeal at 247 lbs. per acre every alternate year.
- (2) Bonemeal at 247 lbs. per acre every year.

(3) Bonemeal at 491 lbs. per acre every alternate year.
The manures were applied in accordance with the above scheme up to the year 1919. No manure was applied either in 1920 or 1921 and the results of these two years are the residual effects of the previous applications. The experiments were carried out in duplicate plots of $\frac{1}{10}$ acre each. The first crop of 1915 and the second crop of 1916 were injured by floods.

The results are given below :—

	Yield per acre in pounds.								Average annual crop.
	1915.	1916.	1917.	1918.	1919.	1920.	1921.		
1	2	3	4	5	6	7	8	9	
	2nd crop.	1st crop.	Two crops.	Two crops.	2nd crop.	Two crops.	2nd crop.		
Bonemeal at 247 lbs. per acre in alternate years.	3,338	1,547	4,484	2,612	1,531	5,204	2,061	2,875	
No manure	2,758	1,435	4,164	2,300	1,317	4,822	2,017	2,681	
Bonemeal at 494 lbs. per acre in alternate years.	2,902	1,570	4,277	2,142	1,412	5,218	2,420	2,554	
No manure	3,013	1,536	4,066	2,250	1,392	4,791	2,009	2,725	
Bonemeal at 247 lbs. per acre yearly	2,902	1,605	3,812	2,250	1,153	4,805	1,920	2,643	
No manure	3,065	1,475	3,353	2,451	1,160	4,610	1,548	2,494	

On account of the want of uniformity in soils, the above results are not very convincing either way. The plots will be left under observation for three years more and their outturn recorded separately to test the original difference in the plots.

In consultation with the Agricultural Chemist, a new series of manurial experiments with bonemeal, phosphate and basic slag has been laid down, in plots whose relative productivity has been ascertained during the two previous seasons, by taking their outturn separately.

(b) Green-manuring with *Dhaincha* for *sail* paddy :—

	Yields per acre in pounds.			
	1920.	1921.		
1	2	3		4
		1st crop.	2nd crop.	Total.
<i>Dhaincha</i> and bonemeal at 247 lbs. per acre (applied in 1920 only).	2,504	...	2,187	2,187
No manure	2,363	1,125	1,950	3,075
<i>Dhaincha</i>	2,295	...	3,059	3,059
No manure	2,363	1,106	2,229	3,335

The experiments were carried out in duplicate plots of $\frac{1}{10}$ acre each which showed considerable variation. Too much reliance cannot be placed on these figures. The results indicate, however, that if a single crop is considered, the advantage in favour of manuring is quite appreciable but if the outturn of two crops are considered, there is a definite loss. The cost of growing an extra crop will be nearly balanced by the cost of manure. It is, however, most likely that by growing crops continuously without manure, fertility of the soil will be depleted when the advantage of manuring will be shown. The experiments will be continued.

The individual plots in the experiment of bonemeal *plus* oilcake for paddy showed so much variation that the results are discarded as being unreliable.

(c) Fish Manure :—

The district of Sylhet, perhaps, produces the largest quantity of fish in the whole of Assam and Bengal. A large quantity of fish, both fresh and dried, are exported and there is a big industry in extracting fish oil. A considerable quantity of fish offal is produced in the district after extracting the oil and from the refuse of dried fish. The whole of this is now allowed to run to waste. Enquiries were started in 1920, whether enough of this material could be collected at a reasonable cost to enable its utilisation as manure. One sample was examined by the Agricultural Chemist and analysed as follows :—

Nitrogen ... ..	...	3.83 per cent.
Phosphoric Acid ($P_2 O_5$) ..	...	17.72 "
Tricalic Phosphate ... ..	...	38.7 "

With a view to testing its manurial value an experiment was conducted at the Farm, the manure being applied on paddy at the rate of 6 maunds per acre. The experiment was conducted on duplicate plots with the following results :—

		Outturn in lbs. per acre.	Increase.
1		2	3
Manured	... ..	4,389	...
Unmanured	... ..	4,110	279

The results appear to be encouraging. The experiments will be continued.

(d) Trial of late Transplanted rice :—

A few plots were transplanted late in September, after the flood subsided, with the late varieties, *Jharia Sail* and *Gandhi Sail*, which had been tried on the Farm for the last few years. There was, however, continuous and severe drought after the flood and the crop totally failed.

10. The variety trial with K. B. jute has now been discontinued, as the experiments of the last six years have definitely established its superiority over the local variety. Two new varieties of jute, Green olitorious and D 154, have been obtained from Dacca and will be tested against the Kaya Bombai. There is hardly any area in the farm suitable for jute, most of the area being too low and liable to water-logging early in the season. Last year's jute was totally destroyed. About one acre of land was raised and green-manured during the last two years, which will be now used for jute. It is hoped to grow a fairly good crop of jute on this field.

11. This crop is grown at this Farm mainly for obtaining setts and incidentally for teaching the apprentices the method of its cultivation. The six varieties, B 147, B 376, Striped Mauritius, Dacca Ganderi, Local Bombai and Kejo, grown last year were ratooned. Two new varieties, Yellow Tanna and J 33A, were obtained and planted along with the above six varieties in small plots. The germination was good, but continuous and heavy rainfall in April and May and drought from November to January retarded the growth of the crop which gave a very poor outturn. The area

planted in 1921 will be ratooned and all the above varieties have again been planted on small plots as before.

12. Various pulses and other cold weather crops were sown in the Rabi season. There was a continuous and severe drought and, with the exception of potatoes, which were irrigated, none of them gave any crop worth the name. Half of a small plot of peas was irrigated and gave an outturn of 636 lbs. per acre, as against 233 lbs. on the unirrigated area. The pulses have been tried on this Farm systematically since 1919, and have always given very poor results, unless the areas are irrigated. Moreover, as the money value of the pulses per acre is comparatively low, the chances of their being taken up in this Valley, to any appreciable extent, are very poor.

13. Improved Shillong varieties were tested against each other and against a local variety. A small quantity of Italian potatoes, obtained from Bombay and grown along with these, gave very good results. The outturns are given below :—

				Yields per acre in pounds.		
				1919.	1920.	1921.
1				2	3	4
King of Potatoes .. ..	..	...		5,022	11,214	7,395
Windsor Castle .. ..	..	...		5,156	5,502	7,073
Up-to-date ... ..	...	...		2,993	6,113	6,645
Emperor ... ..	...	...		2,424	6,413	5,272
British Queen ... ..	...	...		...	7,002	...
Magnum bonum ... ..	...	...		...	5,548	7,056
Local ... ..	...	...		1,415	7,023	2,829
Italian ... ..	...	...		...	...	10,431

All the Shillong varieties proved superior to the local variety, the King of Potatoes giving on an average the best

results. In addition to the variety trials the following tests were carried out with potatoes :—

- (1) Large seed *versus* small seed.
- (2) Whole setts *versus* cut setts.
- (3) Manured direct in trenches *versus* manured broadcast.

Variety,	Outturn in pounds per acre.		
	Large tubers.	Small tubers.	Excess.
1	2	3	4
King of Potatoes	9,287	7,289	1,998
Windsor Castle	6,109	5,863	246
Average	7,698	6,576	1,122

The quantity of seed required for large tubers exceeded that required for small tubers by 1,757 pounds per acre. As the price of seed potato is more than double of that for ordinary potato, the use of really large tubers would result in heavy loss. Last year the use of large tubers gave even a bigger outturn than the above, but even then its use was not economical. Next year the experiment will be conducted with medium tubers and very small tubers. In the other two experiments the quantity of seed used was the same in both cases and were both conducted with King of Potatoes. They gave the following results :—

Outturn in pounds per acre.		
Whole setts.	Cut setts.	Excess.
1	2	3
6,160	5,494	666
Manured direct.	Manured broadcast.	Excess.
7,703	6,883	820

14. The work with this crop consisted mainly of a trial whether good crops could be grown profitably under local conditions. The work was started in 1920 with a collection of different varieties of tobacco obtained from Raagpur. Most of the varieties grew well, but was heavily damaged by a hailstorm towards the end of the season. This year a single variety, Matihari, which appeared to have done best during the previous season, was grown and has produced quite a good crop. The tobacco is now under fermentation.

Tobacco.

15. The whole of the area capable of growing *Sail* paddy was, after allowing for the experiments, cropped with *Indra Sail*, *George Sail* and *Lati Sail* for seed. On the rest *Asra* and *Aus* were grown. About 15 acres were badly damaged by flood and gave an outturn of 46 maunds only from an area of 5.8 acre which could be actually harvested. From the rest of the area which consisted of 40 acres, 994 maunds and 33 seers of paddy was harvested, consisting of 683 maunds 14 seers *Sail*, 221 maunds 10 seers *Asra* and 90 maunds 9 seers of *Aus*. On an average the outturn of *George Sail*, *Indra Sail* and *Lati Sail* were 2,269, 1,857 and 2,193 pounds per acre. It might be incidentally mentioned that *George Sail* appears to have done best in most of the plots in the Farm this year, and this might be due partly to the higher level of water at the Farm owing to the flood last season.

16. The following quantity of seed paddy was sent out from the Farm for sale and demonstration :—

Name of variety.	Surma Valley.	Assam Valley.	Total.
1	2	3	4
	Mds. sr. ch.	Mds. sr. ch.	Mds. sr. ch.
$\frac{36}{1-30}$	30 35 0	10 0 0	40 35 0
<i>L. P. Aus</i>	1 29 0	1 0 0	2 29 0
<i>Katakura</i>	7 20 0	6 0 0	13 20 0
$\frac{138}{2-6}$	2 35 0	3 20 0	6 15 0
Carried over ...	42 39 0	20 20 0	63 19 0

Name of variety.	Sarma Valley.	Assam Valley.	Total.
1	2	3	4
	Mds. sr. ch.	Mds. sr. ch.	Mds. sr. ch.
Brought forward ...	42 39 0	20 20 0	63 19 0
<i>Indra Sail</i> ...	158 20 0	60 0 0	218 20 0
<i>George Sail</i> ...	68 20 0	40 0 0	108 20 0
<i>Lati Sail</i> ...	71 0 0	30 0 0	101 0 0
<i>Sail Badal</i> ...	.....	15 0 0	15 0 0
<i>Laki</i> ...	.....	0 20 0	0 20 0
Total ...	340 39 0	166 0 0	506 39 0

This includes 297 maunds 14 seers of seeds sent out after the 31st March 1922.

17. Rice bugs caused severe damage to the *Aus* crop. But though they attacked the *Sail* paddy also, both experimental and non-experimental, no appreciable damage was done, mainly due to the practice of bagging. The arrangement made last year for giving the Apprentices a systematic training in identifying and combating the common insect pests, has been given effect to. In addition to assisting in the routine work involved in the Farm operations to check the insects, they were given two practical courses by the Entomological Assistant who visited the Farm twice for the purpose.

18. The receipts and expenditure for the financial year are

Receipts and Expenditures. shown below :—

Receipts—

Amount credited into Treasury ...	Rs. a. p.
Value of seeds supplied for Demonstration (from 1st April) 1921 to 31st March 1921, 407 maunds 54 seers 12 chattaacks at Rs. 3) ...	2,085 8 3
Value of stock in hand, 390 maunds 33 seers 12 chattaacks seed paddy at Rs. 3, Rs. 1,172-8-6 and 279 maunds 30 seers 8 chattaacks ordinary saleable paddy at Rs. 2-8, Rs. 699-6-6 ...	1,223 9 9
Carried over ...	1,871 15 0
	5,181 1 0

	Rs.	a.	p.
Brought forward ...	5,181	1	0
79 maunds at Rs. 2-8 for feed of cattle	197	8	0
Bill outstanding ...	26	6	6
Total ...	5,404	15	6
<i>Deduct value of Farm produce of previous year excluding the value of 21 maunds 15 seers 4 chattacks of seed paddy for Farm. Out of 854 maunds of paddy 604 maunds 27 seers 12 chattacks were sold at Rs. 2-8 per maund, 198 maunds 12 seers 4 chattacks seed paddy at Rs. 3 were sent out for Demonstrations and 51 maunds at Rs. 2-8 were given as cattle food</i>			
	2,234	2	6
Net receipts ...	3,170	13	0
<i>Deduct sale-proceeds of last year realised during the year under report</i> ...	44	0	9
Total ...	3,126	12	3
Expenditure—			
Capital—			
Petty construction ...	5,348	2	0
Purchase of books ...	49	12	0
Purchase of cattle ...	550	0	0
Purchase of machinery ...	50	0	0
Total ...	5,997	14	0
Recurring—			
Establishment... ..	3,851	1	10
Feed of cattle ...	399	15	4
Seeds, plants, manures and implements...	99	15	9
Wages of labourers ...	4,050	0	0
Petty repairs ...	699	11	0
Purchase of medicine ...	69	13	9
Purchase and repairs of furniture ...	182	11	6
Service postage and telegrams ...	74	10	0
Country stationery ...	22	0	0
Other charges ...	48	6	6
Value of seed potato supplied by the Seed Dépôt: 19 maunds 15 seers at Rs. 6 per maund ...	116	4	0
	10,004	9	8
Total ...	16,002	7	8

As the bulk of the Farm area, after providing for the experiments, is now being used mainly for producing seed, the amount actually credited into Treasury is getting smaller. We have now 5.95 acres under actual experiment against an area of 1 acre in 1918. With the expansion of the experimental area there has been a rapid increase of expenditure, both capital and recurring. Moreover, a large proportion of the establishment charges was incurred for training apprentices, for demonstration work, and does not really form part of the Farm expenditure although it is included in the Farm budget.

19. No difficulty is now felt in securing Apprentices, although there is yet a general inclination on their part of looking down upon manual work. The tendency is, however, gradually dying out. Four Hindu, four Muhammadan and one Christian Apprentices are under training with a view to their being ultimately appointed as Agricultural Demonstrators. One Apprentice completed his training during the year and two more will complete their training during the next two months. On account of financial stringency it has not been possible to make any provision for their appointment as Demonstrators during the coming year. One Muhammadan and one Hindu Apprentice are under training for being sent to an Agricultural College for higher training.

20. The Farm staff consists of one Manager, one Assistant Manager, one clerk and one peon. There were considerable changes in the staff during the year. Babu Surendra Nath Gupta who had been in charge of the Farm since July 1915 was appointed first Assistant to the Economic Botanist and deserves credit for his careful management of the Farm during this period. He was replaced by Babu Ishan Chandra Dev, a Sabour Graduate. The permanent clerk resigned his appointment on 31st July and was replaced by an outsider.

21. The Farm was visited once by the Hon'ble Minister of Local Self-Government and twice by the Director of Land Records and Agriculture, once by the Agricultural Chemist and once by the Deputy Director of Agriculture, Assam Valley. The Farm was visited on several occasions by the Economic Botanist who has taken charge of the paddy selection and breeding work at the Farm. The Farm was constantly inspected by the Deputy Director of Agriculture, Surma Valley.

CAMP KARIMGANJ FARM,

29th April 1922.

} J. N. CHAKRAVARTY,
Deputy Director of Agriculture,
Surma Valley.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN
THE ASSAM VALLEY CIRCLE FOR THE YEAR
ENDING 31ST MARCH 1922.

Staff.—I was in charge of the office of Superintendent of Agriculture, Upper Assam Division, till the 5th May 1921, when I handed over charge to Babu Satyendra Chandra Dutta and went to officiate as Deputy Director of Agriculture, Surma Valley. During this short period I was on tour for 31 days.

Babu Satyendra Chandra Dutta had been appointed Superintendent of Agriculture, Lower Assam Division, with effect from 1st April 1921. Since my departure on 5th of May 1921, he was in charge of the whole Valley practically for the rest of the year under report. He was on tour for 193 days.

Srijut Lalit Mohon Das continued in charge of demonstration work in the district of Goalpara and the Garo Hills. He was on tour for 160 days and had privilege leave for 18 days. There are three demonstrators working throughout with their headquarters at Dhubri, Abhayapuri and Bilasipara respectively. In the month of September a passed apprentice was placed under the Agricultural Inspector for training and eventually posting in the district.

Babu Pulin Behari Ghose held charge as Agricultural Inspector, Kamrup, and toured for 252 days. He was assisted by three demonstrators headquartered at Gauhati, Palashbari and Nalbari.

Srijut Mohi Chandra Gogoi remained in charge of the demonstrations in the Dibrugarh and Sibsagar subdivisions till he went on three months' privilege leave on the 24th February 1922 while under the arrangement of transfer to Jorhat, and was relieved by Srijut Debi Prosad Gohain from Jorhat. They were on tour for 219 and 17 days respectively. There are two demonstrators in this circle with headquarters at Tinsukia and Sibsagar.

Srijut Debi Prosad Gohain held charge of the Jorhat, Golaghat and North Lakhimpur subdivisions till the 18th February 1922, when he was transferred to Dibrugarh Circle leaving his charge with Srijut Sarbananda Sarma who had been recently taken into the Department as Manager, Titabar Farm. Srijut Debi Prosad Gohain was on tour in this circle for 195 days and Srijut Sarbananda Sarma for 23 days. Four demonstrators were employed under this charge and headquartered at Jorhat, Titabar, Golaghat and North Lakhimpur.

Maulavi Karim Buksh remained in charge of Nowgong demonstrations throughout the year under report. He was on tour for 319 days and had 15 days' privilege leave. He had three demonstrators to assist him with headquarters at Nowgong, Roha and Samaguri.

Srijut Lalit Nath Kakati held charge as Agricultural Inspector, Darrang, and was on tour for 274 days. He is assisted by only one demonstrator headquartered at Tezpur.

In the Sadiya Frontier Tract Mr. M. Smith continued as Agricultural Instructor, working under the orders of the Political Officer, Sadiya, and was on tour for 98 days.

In the Garo Hills demonstration work was carried out, as in the previous years, by the Garo Demonstrator who worked under the control of the Agricultural Inspector, Goalpara.

Except for the addition of a demonstrator for Goalpara there was practically no increase in the staff during the year under review. The newly created post of second Superintendent in the Valley remained vacant for the most part of the year. There is now an Inspector posted at each district headquarters. The need for increase in the number of demonstrators is really great and pressing; so much is their paucity that one of the Inspectors has only one demonstrator and another only two demonstrators to supervise whereas they should have 5 or 6. Hitherto the desired expansion could not be effected on account of the limited supply of trained apprentices but now a greater difficulty has arisen in the financial stringency of the Province.

2. Demonstration work in the Assam Valley.—The work of previous years was continued with necessary modifications. During the year under report closer attention was paid to the concentration of the activities of the staff within the village

groups initiated at the close of the previous year. The following are the main items of demonstration work :—

- (1) Rice—manuring and varieties.
- (2) Sugarcane—demonstration and distribution of improved varieties, use of three roller mills and shallow *gur*-boiling pans.
- (3) Jute—demonstration and distribution of Kakya Bombai.
- (4) Potatoes—demonstration of Shillong and Darjeeling, varieties and distribution of Shillong seed.
- (5) Miscellaneous crops—introduction of pulses, groundnuts, *Arhar*, cotton, etc.
- (6) Fodder crops—popularisation of the Guinea grass.
- (7) Conservation of cow-dung, ashes, etc.—in manure sheds.

It is only about a year that the village groups were formed and each demonstrator was made to restrict his main work to 5 or 6 such groups, each consisting of one or more villages covering an area of about 2—3 square miles; but it has already been realised that only through such concentration lies the road to the success of the demonstration work.

3. *Rice manurial demonstrations—Third year's results.*—The residual effect in the third year of manures applied in 1919 was observed in a few centres in Sibsagar and Goalpara. These demonstrations were originally started with an application of bonemeal, Flour of Phosphate at the rate of 246 pounds per acre and oilcake at 492 pounds per acre, the cost at that time being about Rs. 12 per acre in each case. As the results in the Kamrup district were inconclusive in the previous year no attempt was made to record them this year. The Sibsagar results also appear to be both erratic and unreliable so they have been omitted. In Goalpara bonemeal and Flour of Phosphate gave in the third year an average increase of 418 pounds and 748 pounds per acre respectively, making a total of 890 pounds and 1,269 pounds per acre for three years. These results appear to indicate that the application of a phosphatic manure should prove profitable indeed. But the ordinary cultivators do not show any tendency to come forward to make the necessary cash investment in artificial manures.

Second year's results.—Except in Goalpara the paddy manurial demonstrations organised in 1920 proved useless and were consequently abandoned. As in the previous years bonemeal

and Flour of Phosphate were applied at the rate of 246 pounds per acre and oilcake at the rate of 492 pounds per acre. The results of the demonstrations in Goalpara are given below :—

Field in pounds per acre.

Locality.	Number of demonstrations.	Check Plot.	Bonemeal Plot.	Flour of Phosphate Plot.	Bonemeal and Dhaincha Plot.	Dhaincha Green Manure Plot.	Oilcake Plot.	Oilcake and Bonemeal Plot.
1	2	3	4	5	6	7	8	9
Goalpara	3	1,116	...	1,632	...	...	...	...
Ditto	5	1,544	2,002	...	...	...	...	...
Ditto	2	1,590	...	...	2,037	...	...	...
Ditto	3	2,074	...	...	...	2,224	...	...
Ditto	1	1,140	...	...	...	...	1,502	...
Ditto	2	1,258	...	...	...	...	...	1,463
Average increase in second year.	...	...	1,085	518	483	150	222	186
Average increase in first year	...	...	205	160	467	270	...	206
Total average increase in two years.	...	...	1,335	676	905	420	...	371

Taking the two years' results together the application of all the above manures proves to be very lucrative. But in spite of such good results it has been found very difficult to induce the cultivator to take to artificial manuring. The reason is not far to seek. It is almost impossible for the ordinary cultivator, who are unable to make two ends meet, to provide themselves with necessary funds for purchasing artificial manures, e.g., bonemeal and Flour of Phosphate.

First year's manurial experiments.—In view of the experience gained in recent years it was found useless to waste time and money on demonstrations with artificial or concentrated manures. So they were generally discontinued. Only as a special case 3 demonstrations with oilcake were carried out in Goalpara, their results being an average yield of 1,388 lbs. per acre in the unmanured plots and 1,784 lbs. per acre in the manured plots or an average increase of 396 pounds per acre.

Under these circumstances attention has been diverted from manurial demonstrations to varietal work which now forms the main item in the demonstration programme.

4. *Demonstration with superior varieties of rice.*—During the year under review Lati Sali and *murali ahu*, bred in the Karimganj Farm, were demonstrated for the first time in this valley. As in the previous year George Sali and Indra Sali continued to be demonstrated in suitable places and distributed in the village groups on a larger scale. Besides, Kataktara Ahu, Nagra Sali and Adasra, a kind of shallow water *aman*, were tried in a few places.

Except in the upper two subdivisions of Dibrugarh and Sibsagar the results of the paddy varietal trials were on the whole quite satisfactory, as will be seen in the table given below. George Sali gave an average increase of 254 lbs. per acre in Nowgong, 486 lbs. in Kamrup, and 216 lbs. in Goalpara, 584 lbs. in Darrang and 152 lbs. in Jorhat-Golaghat centres. Indra Sali gave an average increase of 296 lbs. per acre in Nowgong, 428 lbs. in Kamrup, 184 lbs. in Goalpara, 516 lbs. in Darrang, and 108 lbs. in Jorhat-Golaghat centres. Lati Sali gave an average increase of 522 lbs. in Nowgong, 354 lbs. in Kamrup, 234 lbs. in Goalpara and 480 lbs. in Jorhat-Golaghat.

Indra Sali gave persistently negative results in the Sibsagar subdivision as well as in Dibrugarh; so also Lati Sali. As the previous results of Indra Sali were quite erratic in these two subdivisions, closer attention was paid to its trial during the year, but, there were no better results. It has, however, been decided to try it more cautiously in the ensuing season but there appears to be very little prospects of this variety being popular and successful there. George Sali also gave quite erratic results in these two subdivisions. However, its trial will be continued more carefully in future.

Kataktara and *murali ahu* have given good results and are being tried on a larger scale in the ensuing season.

Adasra, though a broadcast kind, appears to be quite useful in lower *sali* lands where it has been successfully grown as a transplanted variety. Nagara Sali gave quite satisfactory results where tried. But in order to avoid complications of too many varieties they have not been taken up for general distribution.

The following statement gives the abstract of results of paddy varietal Demonstrations :—

District.	No. of Centres.	Local Variety.	Indra Sali.	George Sali.	Lati Sali.	Nagara Sali.	Adasra.	Dis.		Increase.	Remarks.
								Katak bara.	Murali.		
1	2	3	4	5	6	7	8	9	10	11	12
Kamrup ...	10	1,716	...	2,903	486	One negative result.
Ditto ...	16	1,934	2,369	...	...	...	...	...	...	438
Ditto ...	6	1,538	...	...	1,002	...	...	...	...	354
Ditto ...	1	2,225	...	...	...	2,395	...	...	...	167
Ditto ...	1	412	...	...	...	...	538	...	...	126
Goalpara ...	16	1,708	1,402	134	One just equal. Negative results in 3 plots. Two negative results. Two equal. Three negative results.
Ditto ...	12	1,650	...	2,006	...	...	...	...	...	246
Ditto ...	12	1,908	...	...	2,142	...	...	...	...	234
Ditto ...	1	2,013	...	...	...	3,619	...	...	...	1,605
Nowgong ...	15	1,970	2,366	...	...	...	...	...	...	296
Ditto ...	4	1,623	2,145	522	254
Ditto ...	12	2,184	...	2,358	...	...	...	...	...	276
Ditto ...	2	1,014	...	...	...	...	...	1,290	...	246
Ditto ...	1	1,230	...	...	...	...	...	...	1,478	108
Jorhat and Golinghat subdivisions ...	12	1,466	1,564	...	...	...	...	...	...	152
Ditto ...	6	1,154	...	1,306	480	618
Ditto ...	2	1,522	...	...	2,002	...	...	...	...	618
Darrang ...	7	2,968	3,414	...	...	...	...	...	...	684
Ditto ...	6	2,748	...	2,222	

5. *Distribution of seeds of superior varieties of rice.*—During the year under review the following quantities of seed paddy were distributed and used in demonstrations:—

—	George Sali.	Indra Sali.	Lati Sali.
1	2	3	4
	Mds.	Mds.	Mds.
Goalpara	10	20	10
Kamrup	21	55	16
Nowgong	10	20	5
Darrang	5	10	2
Jorhat-Golaghat	12	32	7
Sibsagar-Dibrugarh	10	20	4
Total	68	157	44

The distribution of seed paddy is being slowly pushed on for the last few years and the results in the year under report appear to fully justify the expenditure and trouble taken thereat. Consequently arrangements have been made to undertake the distribution on a larger scale in the ensuing season when it is intended to deal out no less than 200 maunds of Indra Sali, and 150 mounds each of George and Lati Sali in the Valley.

Breeding of superior varieties of paddy suitable to different local conditions is the most important problem for the Department as there can be nothing like the results of improved seeds to catch the eye of the cultivator and as it is the cheapest and quickest way to improve his cultivation. The establishment of the Titabar Rice Farm, therefore, was looked to as the most important undertaking the Department could launch in, thus it is very unfortunate that this had to be kept in abeyance on account of the financial stringency of the Province.

6. *Superior varieties of sugarcane.*—Since the beginning of the demonstration work in this Valley the three superior varieties of sugarcane, *viz.*, Striped Mauritius, B147 and B 376, have been vigorously pushed on. They have already

firmly established their superiority over the local canes and become exceedingly popular. Consequently, demonstrations appeared to be superfluous except in Darrang and Lakhimpur where a few comparative trials had been made. In Darrang the improved canes gave an average yield of 46 maunds 7 seers (3,786 pounds) per acre against 30 maunds 14 seers (2,488 pounds) per acre from the local canes. In Dibrugarh these canes have greatly been appreciated by the cane growers on the virgin tracts and their cultivation is rapidly extending there.

Wherever introduced and given a fair trial these canes have been exceedingly popular. They are now known in many places under such familiar names as "Aki maris" ("Aki"-striped) and "Bilaty Pura"—the former being applied to Striped Mauritius and the latter to the Barbadoes canes. Their disease resisting capacity and better ratooning quality have been fully appreciated. The only weak point about them is that they are more attractive to jackals, which cause considerable damages in some localities, sometimes destroying 20—30 per cent. of the crop. On this ground alone the Tana canes, which are too thick and hard for the jackals, have found favour in many places, although they are decidedly poor and inferior. The cultivators want a cane that would remain erect, give good ratoons, keep off jackals, prove resistant to diseases and give a reasonable yield with such manuring and cultivation as they can give. Their requirements are likely to be more closely met by the canes lately selected by the Agricultural Chemist on the Jorhat Farm. They are the J33A, Co9 and D74 varieties—the first a thin reed like cane, the other too thick and erect and all heavy cropper with rich and pure juice. J33A had been tried in the cultivators' fields near Jorhat for the last two years and promises well while the other two have this year been given out for the first time. These newly selected canes specially J33A and D74, hold out even greater hopes than their predecessors the Barbadoes and Striped Mauritius canes.

7. Distribution of sugarcane setts.—The demand for the improved canes is so great that requisitions for their setts literally pour in from all quarters during the cold weather. This year the demand in the Upper two districts amounted to 2½ lacs and the demonstration staff in the Lower districts offered to dispose of any quantity that could be supplied. Thus the matter of doing justice to this demand has become a problem for the Department.

Hitherto we have been trying to get our supply mainly through the return system of setts—an arrangement by which suitable cane cultivators are given the improved setts on the

condition of returning double the number of setts given. This arrangement has proved very successful where the returned setts could be locally used by putting the would-be grower in touch with the other cultivator, otherwise the expense and trouble of collection and risk of damage and damages on transit to other places appear to make it scarcely worth the while to get the returned setts. Besides, there are practical difficulties in collecting setts from a number of cultivators who crush only a small quantity of canes at a time in their leisure or convenience. Under these circumstances it appears desirable to make some changes in the methods of operation in future. It would perhaps be better and cheaper to restrict the issue of setts on return system to suitable growers in conveniently situated localities and large growers of canes in accessible places. With a view to facilitate matters a considerable area (about 2 acres) in the Jorhat Farm has this year been put under Co9, D74 and J33A which are intended for distribution of setts next year.

As to the supply of setts in this season the Jorhat Farm furnished 50,000; 30,000 setts were received back from the canes growing centres in Sibsagar and 45,000 were purchased from the growers of our improved varieties in Dibrugarh, Jorhat and Golaghat subdivisions. They were disposed of as follows:—

Supplied to Surma Valley	...	10,000 setts.
Ditto Kamrup	...	19,000 "
Ditto Goalpara	...	17,000 "
Ditto Nowgong	...	18,000 "
Ditto Tezpur	...	12,000 "
Ditto North Lakhimpur	...	3,000 "

and the rest used for demonstration and distribution in the Sibsagar district and Dibrugarh subdivision. In addition to these a very large number of improved setts must have been given away or sold by private arrangements by the cultivators who grew our improved canes.

8. *Sugarcane mills and gur-boiling pans.*—Three roller iron sugarcane mills are now quite familiar and popular throughout the Valley. Of course one would still find the antiquated wooden mill driving on with the shrilling noise in the *gur* season here and there. But it is not due to the ignorance of the cultivators. They are either unwilling or unable to block a large amount in the first cost of an iron sugarcane mill or cannot combine amongst themselves to purchase a mill jointly. Partly due to the high price of the mills and poorer prospects in the cultivation of sugarcane and perhaps also because a large number of mills had been purchased in the previous years, there was a great drop in

the sale of sugarcane mills in this season, only 107 being sold as against 258 in last year. The following statement gives their distribution to the various districts :—

Sugarcane mills, 1921-22.

District.	Number sold.	Number issued on demonstration.	Total.
1	2	3	4
Kamrup	44	1	45
Goalpara	5	1	6
Darrang	3	2	5
Nowgong	14	...	14
Sibsagar	37	...	37
Lakhimpur	4	...	4

As a consequence of the popularity of the three roller mills private business men also are beginning to import them, whereas formerly they used to deal only in the two roller mills. The Agricultural Demonstrator, Golaghat, reports that one local firm there imported and disposed of 7 three roller mills this year and it is believed that many others did the same in other places.

Our attempts to interest local Workshops and Firms in manufacturing these mills have not yet borne any fruit. The three mills manufactured by the Jorhat Railway Workshop have failed to prove as efficient as the Calcutta mills, while others did not turn out any.

The use of shallow *gur*-boiling pans also is expanding in popularity. In this season 32 pans were sold and 7 issued for demonstration through the Seed Depôt, Gauhati.

9. *Jute demonstration.*—The improved variety “Kakya Bombai” selected by the Fiber Expert, Bengal, continued to be demonstrated with satisfactory results. The demonstrations were all destroyed by floods and unfavourable weather in Kamrup and Goalpara. The results of those in Nowgong, Tezpur and Golaghat show an average increase of 454 pounds, 178 lbs. and 86 lbs. per acre respectively.

Except in Goalpara jute is not looked upon as a money crop by the indigenous cultivator who shows great dislike for the work involved in retting and washing the fibre. Besides, the general standard of his cultivation is low and he is not accustomed to the use of manures and to the careful after cultivation without which

jute does not give good results. For all these reasons the cultivation of jute is making very slow progress in gaining popularity. But the recent immigration of the Sylhet and Mymensing people, who have settled in large numbers in Darrang, Kamrup and Nowgong, has changed the situation as they are familiar with the crop and extensively cultivating it as a money crop. It may be hoped that the indigenous cultivator will soon immitate them and take to jute cultivation largely. During the year under report the following quantities of improved jute seeds of Kakyia Bombai and R85 varieties have been distributed—30 maunds in Nowgong, 10 maunds in Goalpara, 5 maunds in Darrang, 4 maunds in Kamrup and 3 maunds in Sibsagar and Lakhimpur.

10. *Potato demonstration.*—Demonstrations with superior varieties of Shillong potatoes formed the most important item in the cold weather demonstration programme. A large number of demonstrations were carried out for comparison of the Shillong potatoes with local or Bazar seeds planting them in the ordinary way of the cultivator as well as with a heavy application of cowdung at the rate of 150 maunds per acre and spacing the rows 2 feet apart setting the tubers 9 inches distant. The potato blight was very serious this year and destroyed almost the entire crop in the Sibsagar and Lakhimpur districts. In Nowgong and Darrang also it was pretty bad and only a few of the demonstrations there were saved. The available results are given below :—

Potato yield in pounds per acre.

District.	Number of Demonstrations.	Local seed and local method, i.e., cultivation without heavy manuring.	Local seed with improved methods, i.e., with 150 maunds of cowdung per acre.	Shillong seed and local method.	Shillong seed and improved method.	Local seed without irrigation.	Local seed with irrigation.
1	2	3	4	5	6	7	8
Kamrup	20	3,305	4,207	4,625	5,769	...	...
Goalpara	30	2,714	...	3,365	4,346	...	...
Nowgong	8	3,374	4,070	4,192	4,794	...	...
Darrang	1	...	...	...	...	8,706	12,028
Ditto	3	5,232	...	6,944	...	...	...
North Lakhimpur ...	3	3,221	...	5,262	...	...	...

In Darrang irrigation was tried in one place and gave the wonderful increase of 3,322 lbs. per acre which goes to indicate that irrigation should prove exceedingly paying. Next striking are the figures of Shillong potatoes grown with better manuring and better cultivation which gave the increase of 2,464 lbs., 1,631 lbs. and 1,420 lbs., over the corresponding yields of local seed and local method plots in Kamrup, Goalpara and Nowgong respectively. The Shillong potatoes grown in the ordinary way gave the increase of 1,320 lbs., 651 lbs., 818 lbs., 1,712, lbs. and 2,041 lbs. per acre over the local seed in Kamrup, Goalpara, Nowgong, Darrang and North Lakhimpur respectively. Even the local seed gave better outturn with improved cultivation, the increase being 902 lbs. and 696 lbs. per acre in Kamrup and Nowgong respectively. It may be mentioned here that even in cases where crops were destroyed by the *Phytophthora* Blight the Shillong seed produced some crop, though small, whereas the country seeds did not yield any which was evidently due to their lateness in forming tubers.

This year Darjeeling potato was again tried against the Shillong potato but no definite conclusion could be arrived at as the potato blight destroyed or vitiated all such demonstrations laid down in the Jorhat and Tezpur Circles. Out of the 3 places tried in Kamrup the Darjeeling potato was planted late in one and consequently the results were not acceptable, while in another there was no difference in the outturns; but in the third the Darjeeling potato gave an increase of 2,075 lbs. per acre, the yield being 8,878 lbs. and 6,893 lbs. per acre. Under the circumstances it would be worth the while to repeat this next year.

During the year under report 1,360 maunds of seed were disposed of through the Gauhati Seed Depot; out of this quantity 469 maunds were used in demonstrations and free supply and the rest sold to cultivators.

11. *Potato blight*.—The potato blight (*Phytophthora infestans*) appeared again this year and played havoc with the potato crop in Upper and Central Assam. It was never so serious as in this year. The climatic conditions became extremely favourable with the rains in late December and early January which the cultivators term "Bih Barashun" or poisonous rain, and the disease spread rapidly. Attempts were made at Kakilamukh to control the disease by spraying the crops with Bordeaux mixture but the disease had already fairly established before any action could be taken. Consequently there were no appreciable results. It is reported that the blight appeared

suddenly after the rains and spread so rapidly and vigorously that there was very little time to give effective help by organising spraying campaigns. The extent of damages caused by the blight this year is incalculable. All the potato fields, which used to produce luxuriant crops in other years, had not a green leaf by the third week of January when they had not completed even one half of their vegetative growth. Consequently the harvest was in majority of cases even less than the tubers planted. The Hon'ble Minister in charge of Agriculture had seen the state of the crop when he visited Kakilamukh demonstrations in January last and was struck with the severity of damages. The problem of controlling the potato blight is engaging the serious attention of the Department and it is proposed to carry on extensive experimental work in next cold weather for observing the course of the disease under local climatic conditions and the effect of spraying on the same.

12. *Demonstrations with miscellaneous crops.*—A number of miscellaneous crops were tried as in previous years in various places in the Valley. They were as follows :—*Rahar*, Patnai *Khesari*, *Masur* and *Matikalai*, *Sona Mung*, *Jowar*, Maize, Groundnuts, Pusa wheat and *gangajali* wheat from Northern Bengal, Linseed, Garo and other cottons, *Boro* paddy, etc.

In Sibsagar district *Rahar* gave indifferent results owing to attacks of weevils. Patnai *Matikalai* and *Sona Mung* gave very satisfactory results in the Jorhat Circle with outturns varying from 448 lbs. to 632 lbs. per acre of Patnai *Matikalai* and 338 lbs. to 796 lbs. per acre of *Sona Mung*. In Golaghat Patnai *Matikalai* farèd much better than the local variety, the former yielding 505 lbs. per acre and the latter 425 lbs. *Khesari* and *Masuri* did not do so well.

In Dibrugarh Patnai *Matikalai* gave an average outturn of 734 lbs. per acre against 473 lbs. of the local seed. Other crops did not give results worth mentioning.

In Nowgong groundnut appeared to do well and Garo cotton gave good results and were appreciated by the people. *Rahar* did not do so well in all the places tried at. Patnai *Matikalai* gave good results and appeared to be appreciated as its grains are larger and the yield higher. *Sona Mung* also gave very satisfactory results with outturn higher than the local seed. Patnai *Khesari* appeared to do well both as *paira* crop (i.e., as sown in the midst of the paddy crop) and a field crop but Patnai *Masuri* made only indifferent growth. Maize and *Jowar* also grew well. The Pusa wheats Nos. 4 and 12 did not do well.

In Darrang groundnut gave very high yields and prospects of this crop appear to be very hopeful. The outturn of *Sona Mung* and Patnai *Matikalai* was very poor while *Rahar*, Pusa wheats as well as *Gangajali* wheat fared no better.

In Kamrup the results of the Patnai seeds of *Khesari* and *Masuri* were disappointing as ever but the *Matikalai* and *Sona Mung* thrived better. Linseed and wheat were grown in few centres with satisfactory results. Owing to late planting the Jari cotton from Central Provinces could not get a fair trial and did not do well.

In Goalpara the Pusa wheats and Patnai pulse seeds gave poorer results than the local seeds. *Boro* paddy has been tried and appeared to thrive well near Fakirganj but their ultimate results are yet to be seen.

In North Lakhimpur Patnai *Musari* and *Khesari* were tried but failed miserably. Pusa wheat tried at three places gave an average outturn of 1,150 lbs. per acre.

The foregoing is but a poor record with poor results for the enormous quantity of labour and expenses involved. This is mostly due to the absence of proper experiments to guide the demonstration staff and want of properly acclimatised and selected seeds. What good results are obtained here and there are the results of guess work or chances as most of our cold weather demonstrations with these crops have to be based on theoretical expectations and not on actual experiments. This line of action cannot too strongly be deprecated but there can be no help till we get at least one experiment station in Lower Assam for *Rabi* season crops. The problem of improving and increasing the cultivation of the *Rabi* crops is of vital economic interest to Assam.

13. *Fodder crops*.—The problem of supplying fodder crops is acute only in the congested parts of some districts in the Valley, which fortunately are not many. Yet it is of general interest to all cultivators as they cannot continue long with this present system of allowing their cattle to shift for themselves by picking what and where they can. Consequently arrangements are being made to introduce the Guinea grass, which has done so well in the Jorhat Farm, into suitable localities all over the Valley.

It is a common practice in Goalpara to grow a large area of *Khesari* and use the luxuriant green crop as cattle fodder.

Attempts had been made to introduce this crop, sowing it in the midst of the standing paddy crop, into Upper Assam for the purpose of serving as a fodder, if it fail to seed, but owing to the apathy of the cultivators the results were far from encouraging. But it is apparent that efforts should be repeatedly made to popularise the idea of growing fodder crops for the cattle in the same way as the cultivators grow crops for their own consumption.

14. *Conservation of cattle manure.*—Great stress has been laid on the conservation of cattle manure and village refuses in covered pits or sheds. During the year under report the following number of pits or sheds were erected through the efforts of the officers of the Department—50 in Kamrup, 59 in Sibsagar and 17 in Lakhimpur.

The Agricultural Inspector, Goalpara, reported that in spite of continuous efforts made by himself as well as his demonstrators they could not succeed in getting any manure shed erected. The Agricultural Inspectors, Darrang and Nowgong, have not made any mention of their achievements in this direction. I hope that the whole staff will make better exertions and that there will be better reports to record next year. The importance of conserving the manurial resources at hand can scarcely be exaggerated. In a place like the Assam Valley where intensive and careful cultivation is practically unknown it is only quite natural that the cultivator would not care for the conservation of cow-dung, ashes and refuses for manurial purposes. It is for the agricultural officers to educate them. I should strongly exhort our officers to always bear in mind that for improved cultivation and better yield a plentiful supply of cheap manurial matter is essentially necessary. It is useless to recommend better crops, requiring good manuring for good results, to a cultivator who either does not understand or does not care to preserve his cow-dung and other refuses in a manure shed.

15. *Agricultural work in the Sadiya Frontier Tract.*—Mr. Smith was in charge of this work which continued as in the previous year and consisted of the management of the small experiment station near Sadiya and carrying on demonstration work at Pasighat, Rotung, Remindambong and Denning, distribution of seeds, plants, etc., demonstration of terrace paddy cultivation and the improvement of cattle by the maintenance of stud-bulls and castration of inferior local bulls.

The Sadiya Experiment garden is situated at a distance of $2\frac{1}{2}$ miles from the town and has about 9 acres under cultivation

with a rich loamy virgin forest soil. The following crops were grown during the year :—

Sugarcane.—The varieties grown are Striped Mauritius and B147. Striped Mauritius gave better results this year yielding $64\frac{1}{2}$ maunds per acre in the plant and $83\frac{1}{2}$ maunds *gur* per acre in the ratoon crop against $45\frac{1}{2}$ maunds *gur* per acre in the plant and $63\frac{1}{2}$ maunds per acre in the ratoon crop of B147.

Groundnuts.—were tried in four places, two on $\frac{1}{10}$ acre plots one on $\frac{1}{2}$ acre plot and one $\frac{1}{4}$ acre plot, their yields being $12\frac{1}{2}$, 8, $16\frac{1}{2}$ and 9 maunds respectively. Rats caused some damages to the crops in all the centres.

Garo cotton.—This was tried on $\frac{1}{4}$ acre. The seeds germinated well but heavy rains destroyed most of the seedlings. The remaining plants made much vegetative growth and only a few bolls could be harvested.

Shillong maize.—Three of the best varieties tried on $\frac{1}{10}$ acre plots yielded $9\frac{1}{2}$, $12\frac{1}{2}$ and $10\frac{1}{2}$ maunds respectively. Some damages were caused to the crops by parrots as well as rats.

Aus paddy.—The two varieties of *aus* paddy, that did well last year, namely Kataktara and C. P. Aus, were again tried on $\frac{1}{2}$ acre plots. Kataktara gave an outturn of 16 maunds 4 seers while C. P. Aus gave 17 maunds 12 seers per acre.

Dhaincha.—was grown for seed on one acre but only one-third of it could be harvested and the rest was destroyed by hail storm. The area harvested yielded at the rate of about 10 maunds per acre.

Coffee.—The plants are thriving, $4\frac{1}{2}$ seers of berries being picked this year.

Fruit trees.—Guava, litchi, lime, peach, orange and pomelo trees are doing well. A few guava grafts were distributed and some guava and lime fruits were sold during the year.

At Pasighat.—On account of anti-malarial operation the work had to be practically closed and no terrace cultivation was carried on.

At Rotung.—the Abors cultivated $12\frac{1}{2}$ acres of terraced rice with exceptionally good results. Orange trees are flourishing there and most of the trees in the fort fruited this year.

At Remindambong.—half an acre was under terrace cultivation carried on by the Abors but the yield of rice was poor on account of irregular water supply.

At Denning—one acre and a half was under terrace and yielded at the rate of 25 maunds and 8 seers rice per acre.

Shillong Potatoes.—Twenty-three maunds of seed potatoes were supplied to cultivators. The potato crop suffered very badly on account of the potato blight.

Tobacco.—Half a seer seed of Bhengi and Matihari from Rangpur was distributed in the Assamese villages and very satisfactory results were obtained except in places where the crop was destroyed by the hail storm.

English vegetable seeds.—These were sold in small packets and were quite popular with the local people.

Improvement of cattle.—Two stud-bulls are kept at Sadiya and two more at Pasighat. Besides, two more were brought from Pasighat by the cattle owners at Sadiya. Castration of inferior bulls continued. During the year under review 113 such bulls were castrated, 64 at Sadiya, 24 at Pasighat and 25 at Kobo.

16. *Agricultural work in the Garo Hills*.—This work is in charge of a Garo Demonstrator who works under the nominal supervision of the Agricultural Inspector, Goalpara. This arrangement, as the Agricultural Inspector cannot pay as close an attention as desirable, is far from satisfactory. During the year under report the Inspector visited the Garo Hills only once in November 1921.

As in the last year potatoes formed the main item of demonstration. Twenty maunds of seed potatoes were planted on 18 plots in 13 centres. The size of the plots were rather small varying from $\frac{1}{3}$ to $\frac{1}{10}$ acres, the results, however, were somewhat better than those of last year, the average outturn being 35 maunds against $23\frac{1}{2}$ maunds per acre in the previous year.

During the year under report the Agricultural Demonstrator had spent the best part of his energy and attention in assisting in and laying out school gardens all over the district. The idea is to grow fruit trees and vegetable in the school compound and try to make their cultivation popular with the pupils and the surrounding people. The report is that these school gardens had succeeded in making a good beginning and found favour in many a centre and their prospects appear to be hopeful.

The Demonstrator had been at great pains to popularise grafting and pruning of fruit trees. A large number of oranges mangoes and a few others, e.g., litchis, jack and guava trees

are reported to have been pruned during the year. Besides, he distributed some vegetable seeds, sold a few gardening implements and collected and supplied some Garo cotton seeds to the seed depôt.

17. *The Jorhat Seed Depôt.*—The Jorhat Seed Depôt had been sanctioned some time ago and provisions made for the same in the budget for 1921-22. But there being no Superintendent of Agriculture at Jorhat to look after the depôt effect was not given to this till towards the close of the season. However a clerk was appointed in the middle of December 1921, and sent for training at the Gauhati Seed Depôt and necessary accommodation was secured in two rooms in the Public Works Department buildings of the old distilleries. Subsequently these rooms were taken over temporarily for the use of the Assam Rifles and were not available till the middle of March. But they needed some repairs and were ready to be occupied only towards the close of the year. In the meantime furniture had been purchased and necessary books and registers got ready at a cost of about Rs. 500; but practically no business transaction was carried on during the year under report except the sale of 6 sugarcane mills supplied by the Gauhati Seed Depôt.

18. *Annual Report of the Seed Depôt, Gauhati.*—Babu Satyendra Chandra Dutta held charge of the Seed Depôt except for the first five weeks, when I was in charge. Srijut Narain Chandra Goswami continued as the Seed Depôt clerk with a despatcher to assist him. To cope with the increased work during the potato season a temporary hand was entertained for four months and was found very helpful. During the year under report administrative sanction was given to the appointment of an additional clerk as the Seed Depôt Head Clerk on Rs. 50—2½—75, so that, proper security could be taken and better services obtained. The post has been duly filled up from the first April 1922.

The work of the Seed Depôt which was expanding every year by leaps and bounds appeared to have received a sudden check during the year under review. There was a great decrease in the demand for the three roller sugarcane mills of which only 101 were sold as against 267 in the previous year. This item alone accounts for almost the entire fall in the receipts of sale-proceeds of the year. Various factors must have been responsible for this, the most important ones being the fall in the *gur* market and the higher price of the sugarcane mills. Otherwise the work of the Seed Depôt continued to progress on healthy lines.

Altogether there were 47 items of seeds, plants, manures and implements dealt with during the year. The following table gives the conspicuous of the items of sale-proceeds :—

Name of articles.	Quantity sold.	Quantity supplied free.	Total quantity issued.	Value.
I	2	3	4	5
	lbs.	lbs.	lbs.	Rs. a. p.
Potato	71,315	37,562	1,08,877	9,025 8 9
Wheat	11,365	761	12,126	1,423 11 0
Jute seed	1,075	4,479	5,554	1,341 14 6
Indra Sali... ..	477	9,530	10,007	655 5 0
Barley	4,001	28	4,029	435 15 6
Dhaincha	2,260	2,320	4,580	341 0 0
Bone-meal... ..	3,550	50	3,600	308 3 0
George Sali	327	4,386	4,713	265 4 3
Kotaktara Ahu ... ..	...	4,160	4,160	234 0 0
Oats	1,040	856	1,896	200 6 0
Lati Sali	890	2,090	2,980	173 6 0
Khesari	1,147	1,601	2,748	168 12 9
	Packets.	Packets.	Packets.	
Vegetable seeds	8,862	136	8,998	1,678 14 0
	Nos.	Nos.	Nos.	
Sugarcane mills	101	25	126	15,550 6 0
Gar-boiling pans	32	7	39	1,679 5 0

The total quantity of seeds and manures issued during the year was about 82 tons valued at Rs. 17,836 as against 84½ tons valued at Rs. 14,486 during the last year. Out of these nearly 46·7 tons valued at Rs. 10,421, as compared against 60 tons valued at Rs. 9,321 of last year, were actually sold and the remainder used for demonstration and free distribution. The main item was 1,360 maunds seed potato as against 1,534 maunds in the previous year. The small seed packets of European vegetable continued to be popular, some 8,998 packets valued at Rs. 1,678 being dealt with during the year.

The value of implements issued amounted to Rs. 17,620 of which Rs. 14,843 were actual receipts by sale. As in the previous year the principal item was the sugarcane mill of which 101 were actually sold.

During the year under report the supply of the bulk of the sugarcane sett issued for demonstrations or free distribution was carried on with the demonstration grants, their accounts therefore do not enter into the seed depôt transactions.

The profit and loss account of the seed depôt is given below. Allowing for all charges, including depreciation, establishment, rent, etc., the financial results of the year's working is a nett loss of Rs. 978-13-6 as compared against a nett profit of Rs. 1,015-14-11 in the previous year. The unfavourable results may be attributed to three reasons, *viz.*, (1) the decrease in the demand for sugarcane mills, (2) an unfavourable potato market which led to the disposal of some 202 maunds at Rs. 2-8 per maund, *i.e.*, at a loss of Rs. 5 per maund and (3) the increase in the establishment and contingent charges specially that of service stamps. It is satisfactory to note that the outstandings of the previous year were all realised and the amount of bills outstanding at the close of the year was a small sum of Rs. 370-13-9 composed mainly of V. P.'s issued at the close of the year which has since been realised. Thus the transactions of the seed depôt have successfully been placed on the sound basis of cash or V. P. P. system. There was slight decrease in the value of stock in hand during the year. It consisted mainly of sugarcane mills, other implements, manures and seed paddy which should all fetch the price valued at; but, however, the usual 10 per cent. depreciation has been charged in the statement of accounts which must, therefore, be on a sound basis.

A considerable portion of the credit of the successful working of the seed depôt is due to the hearty co-operation of the district demonstration staff of the Inspectors as well the demonstrators. Amongst them the following deserve special mention:—Inspectors—Babu Pulin Behari Ghose, Srijut Lalit Mohan Das and Sheikh Karim Buksh and Demonstrators—Anandiram Gohain, Bhadhar Phukan and Sheikh Umar Ali.

1	2	3	4	Rs. a. p.	Rs. a. p.	Rs. a. p.
Total sale-proceeds credited during the year ...	25,264 7 0	...	...	...	...	549 0 0
Bills outstanding ...	370 13 9	...	...	...	262 7 10	871 5 4
Value of stores used in Demonstration and free supply	10,032 14 9	...	...	...	430 0 0	869 3 3
Value of concession to Honorary Correspondents ...	159 0 0	...	...	...	96 13 8	...
<i>Debit—</i>						
Outstanding of last year	...	35,827 3 6	...	...	...	2,289 10 7
	...	4,034 0 0	...	...	30,471 9 7	...
	...	...	...	...	1,551 0 6	...
	...	...	...	...	151 8 0	...
Total Assets ...	...	31,793 3 6	...	...	473 11 2	...
Profit and loss account	...	...	...	...	...	28,295 5 11
	...	...	...	...	...	443 3 0
	...	...	...	...	...	34 10 6
	...	978 13 6	...	...	...	144 8 3
	...	...	...	...	...	978 1 0

	...	...	...	...	5,019 2 6	...
	...	...	...	...	4,438 8 9	586 9 9
Total	...	32,772 1 0	...	...	Total	32,772 1 0

19. *Distribution and sale of improved seeds.*—The following statement gives a few of the most important items of improved seeds and enables to form a rough idea of the amount of work in their distribution and sale through the district staff. This work itself is not much but as a result of past demonstrations the cultivators have been able to learn to preserve themselves a good deal of improved seeds for their own use as well as for their neighbours. In addition to these a considerable quantity of various seeds have been issued directly from the seed depôt.

Quantity of improved seeds in pounds sold or distributed in Assam Valley through the demonstration staff.

Kind of seed.	In Goalpara district.	In Kamrup district.	In Nowgong district.	In Darang district.	In Sibsa-gar district.	In Lakhimpur district.	Total.
1	2	3	4	5	6	7	8
Indra Sali ...	1,600	4,400	1,800	800	2,560	1,600	12,560
George Sali ...	800	1,680	800	400	960	800	6,440
Lati Sali ...	800	1,280	400	160	840	320	3,800
Jute K. B. ...	800	320	2,400	400	320	80	4,320
Shillong potato ...	8,440	13,100	10,400	2,880	23,120	800	58,740
Arhar ...	480	320	1,200	400	240	80	2,720

20. *Estimated area under improved crops.*—Estimated acreages under the crops grown with the improved seeds, either selected or recommended by the Department, are given below. In the absence of a detailed survey these figures could not be more accurate than the guess work of the men on the spot; but they are more likely to be underestimates.

Estimated area in acres under improved crops.

Variety.	In Goalpara.	In Kamrup.	In Darang.	In Nowgong.	In Sibsa-gar.	In Lakhimpur.	Total.
1	2	3	4	5	6	7	8
George Sali ...	55.0	50.0	6.0	26.0	50.0	31.0	221
Indra Sali ...	68.0	175.0	15.0	6.0	35.0	30.0	381
Lati Sali ...	15.0	2.0	3.0	10.0	5.0	3.0	66
Improved Jute (K. B.) ...	40.0	20.0	30.0	125.0	5.0	2.0	222
Improved sugarcane (S. M., B. 376 and B. 147) ...	20.0	45.0	5.0	43.0	250.0	55.0	418
† Shillong potato ...	8.0	6.0	15.0	45.0	30.0	4.0	108

* N. B.—The area under sugarcane given above, does not include the area under improved canes in the European Sugar Estates in Kamrup.

† The area under potato stated above gives only the approximate area planted with the seeds issued by the Department. This represents only a fraction of the total potato area at least, of which must have been planted with the Shillong seeds purchased in the Bazar, most of which are as good as the seeds handled by the Department, the seed of their place of origin having been improved through the departmental activity.

21. *Miscellaneous notes.—Floods.*—Two successive floods of the Brahmaputra in May and August 1921, caused considerable damages to the jute, *Aus* and *Aman* crops on the riparian areas, specially in Lower Assam. The damages in Goalpara were quite extensive and severe so much so that agricultural loans had to be freely given by the Government and the Zamindars had to come to the help of the suffering ryots. To meet the demand for seed for the cold weather a large quantity of wheat seed, some *Boro* paddy and cold weather seeds were either sold or distributed.

Co-operation with the Department of Credit Societies.—For the purchase of improved implements and seeds, e.g., three roller sugarcane mills, Shillong seed potatoes, cultivators find great difficulty in providing themselves with necessary funds. It is very much desirable that the resources of the Co-operative Societies are utilised for the purpose. It is satisfactory to note that through the exertion of the Agricultural Inspector, Kamrup, three cultivators in Kamrup took the aid of Co-operative Credit Societies and purchased three sugarcane mills. It is hoped that other officers also will exert their best to bring themselves in touch with the Co-operative Societies in their charge and use them for financing the needy and deserving cultivators.

Domordah Farm.—With a view to get superior seeds for sale or distribution attempts were made during the year under review to get them grown through the Honorary Correspondents and private gentlemen. Several of them had been approached but the scheme materialised in any shape only in one place. The Dewan of Gauripur offered to co-operate in this matter by giving the necessary facilities in the Estate Farm at Domordah near Balajan (Eastern Bengal Railway). During the year under report a modest beginning was made and a few demonstrations with George Sali, Indra Sali, Lati Sali, Shillong potato, wheat and linseed were carried out with satisfactory results.

22. *Work of the Honorary Correspondents.*—There were 21 Honorary Correspondents in the Assam Valley plains and one in the Garo Hills. Most of them continued to take more or less active interest in the work of the Agricultural Department. Mr. E. P. R. Gilman of Kamrup died during the year under report; the Department lost through his death an enthusiastic and useful Honorary Correspondent.

Mr. D. C. Chakravarty, Dewan of the Gauripur Estate, continued to take active interest in the work of the Department and gave facilities for carrying on demonstrations in the seed production on the Estate Farm of Domordah.

Srijut Bhogodutta Hazarika of Dharamtul, Newgong, grow Indra Sali, George Sali, improved canes and Kakya Bombai jute with good results. Srijut Baloram Hazarika of Kuaritol got excellent results from improved *murali* from Karimganj Farm, *Sona Mung* and improved canes. Babu Jnan Chandra Roy of Baithalongso had a very large area under George Sali and Indra Sali and found them very satisfactory. He also grew improved sugarcanes and distributed their setts in his neighbourhood.

Srijut Protapnarain Chaudhuri of Nalbari tried Shillong potatoes with considerable satisfaction. Srijut Hara Govinda Deka had grown Indra Sali, improved sugarcane, Shillong potatoes, Patnai Masur, etc., with good results. Rai Sahib Rajani Kanta Chaudhury of Sorbhog and Srijut Chandra Nath Sarma of Palashbari bought and cultivated Shillong potatoes and Darjeeling potatoes with excellent results. Maulavi Tazul Islam had a large area under Indra Sali, Lati Sali and George Sali and supplied seeds to the Department

Srijut Sarat Chandra Goswami continued his work on school gardening and secured some success in growing vegetable. Rai Sahib Narayan Chandra Barua grew Lati Sali and George Sali from Karimganj Farm seed and tried several varieties of cotton.

Maulavi Zubeid Ali Hazarika grow Shillong potatoes and tried Indra Sali and Lati Sali with great success.

JORBAT :

The 22nd May 1922. }

L. BARTHAUR,

Deputy Director of Agriculture,
Assam Valley.

**REPORT ON AGRICULTURAL DEMONSTRATIONS
IN THE SURMA VALLEY CIRCLE FOR THE
YEAR ENDING 31ST MARCH, 1922.**

1. Maulavi Fazlul Haque Ahmed, Superintendent of Agriculture, was on leave for 9 months from 24th April to 21st January, covering practically the whole of the working season of the year. Babu Benode Behari Das, Agricultural Inspector, North Sylhet, acted for him in addition to his own duties, being assisted by an Agricultural Inspector for North Sylhet only for 3 months, after which the officer was transferred to Karimganj as Farm Manager. The Agricultural Inspector, Habiganj, was on leave for three months on two occasions and was in indifferent health throughout the year. The Agricultural Inspector, Cachar, was on leave for one month, when the Agricultural Inspector of Karimganj held charge in addition to his own duties. I was also myself on leave for eight months. It will thus be seen that there were considerable changes in the personnel of the staff, and the work was carried on at a disadvantage. The two Probationary Inspectors were posted in charge of the two respective subdivisions of Sunamganj and Karimganj in June and July. For the first time, therefore, one Agricultural Inspector has now been posted in charge of each of the subdivisions in Sylhet and one for Cachar. Most of the Agricultural Inspectors are, however, very junior and lacking in experience. It will take some time before the whole Valley is properly organised, as successful demonstration work depends largely on an intimate acquaintance with the locality and the cultivators. Two additional Demonstrators were appointed during the year, bringing the number to 15, including the one in charge of North Cachar Hills, who were posted as follows :—

Cachar—Haflong, Silchar, Katigorah and Hailakandi.

Karimganj—Karimganj and Barlekha.

North Sylhet—Sylhet and Fenchuganj.

South Sylhet—Maulvi Bazar, Sreemangal and Kulaura.

Habiganj—Habiganj, Shaistaganj and Bejura.

Sunamganj—Sunamganj.

An additional temporary Agricultural Demonstrator was entertained for tobacco demonstrations. More Demonstrators are

urgently wanted for North Sylhet, Karimganj and Sunamganj. Trained apprentices are now available, but unfortunately, it has not been possible to appoint them on account of financial stringency.

Maulavi Fazlul Haque Ahmed and Babu Benode Behari Das as officiating Superintendent of Agriculture spent 45 and 123 days respectively on tour. The latter visited Bhairab Bazar for the purchase of onion seeds, and Cherrapunjee in connection with the transport of seed potatoes and also attended a Departmental Conference held at Gauhati in January 1922. A considerable part of the Superintendent's time was taken up in supervising the work of the Seed Depôt. He visited most of the demonstrations in his circle and constantly checked the work of the Agricultural Inspectors and Demonstrators. The time of the Agricultural Inspectors was taken up entirely in supervising the demonstrations and looking after the sale of seeds. The number of days spent by them on tour were as follows :—

Babu Benode Behari Das, Agricultural Inspector,			
North Sylhet	...	...	60 days.
Babu Ishan Chandra Deb, Offg. Agricultural Inspector, North Sylhet	...	...	59 days.
Babu Profulla Chandra Dutta, Agricultural Inspector, South Sylhet	...	...	257 days.
Babu Kamini Kumar Dey, Agricultural Inspector Habiganj	...	...	210 days.
Maulavi Abdul Quadim Chaudhuri, Agricultural Inspector, Karimganj	...	...	245 days.
Maulavi Mohsin Ali, Agricultural Inspector, Cachar	...	...	236 days.
Babu Romesh Chandra Das, Agricultural Inspector, Sunamganj	...	...	263 days.

The policy of concentrating the energies of Agricultural Inspectors and Demonstrators in a few definite groups of villages is now producing definite improvements and resulting in an increased demand for seeds supplied by the Department, and in a desire on the part of the cultivators to keep themselves in touch with the activities of the Department. Applications to Agricultural officers for help and advice from planters, middle-class men having comparatively big holdings as well as from small cultivators are rapidly increasing.

2. Early in the year, the Agricultural Inspectors and Demonstrators of North Sylhet and Cachar attended the fairs held at Dhakadakshin and Katigorah respectively with a small collection of Agricultural exhibits, particularly of recommended seeds and implements. They attracted considerable attention but on account of the abnormal economical and political conditions of the country they were not as successful as those of the previous years. The Agricultural Inspector, Cachar, awarded a silver medal to a vegetable grower, which was actually presented by the Deputy Commissioner, Cachar. During the rainy season, the Hon'ble Minister of Local Self-Government, the Director of Land Records and Agriculture, the Superintendent of Census and other officials and non-officials visited the demonstration plots at Sadharkhola, about two miles from the town of Sylhet. They were met by a large number of cultivators, and examined various agricultural problems on the spot. The Director of Land Records and Agriculture, accompanied by the Deputy Directors of both the Valleys, visited a large number of demonstration centres again in the winter and mixed freely with a large number of cultivators almost at every place and discussed agricultural matters with them.

The Agricultural Associations of Bejura (Habiganj) and Sonapur (South Sylhet) held several meetings and the members appear to take a genuine interest in the work of the Associations. Another Association was started at Amurah in North Sylhet but has not, as yet, shown much work. The "Jnan Bikashini Sabha" at Dayamir (North Sylhet) also included agricultural improvements in its programme, but very little actual work has yet been done. In Sunamganj, the Chairman of the Village Authority at Derai is taking some interest in the Agricultural Demonstrations, but it is a pity that, in this Valley, it has not yet been possible to take advantage of Village Authorities in pushing our demonstrations.

3. Surma Valley is principally a rice-growing district, and our attempts at improvement hinge mainly on rice. During the first few years, more attention was paid to the question of manures. During the last few years, greater attention is being paid to a wide distribution of improved paddy seed varieties. This has been made possible mainly by the experimental work at Karimganj, as a result of which we are now in a position to recommend several superior varieties suitable to different local conditions of this Valley. Up till 1919, Indra Sail of Dacca and George Sail of Assam were tested in several places with considerable success. In 1920, two

new *aus* varieties and one *sail* variety—all Karimganj Farm selections—were tried in various places with very satisfactory results. Katakara, a Dacca Farm *aus* variety, was also grown in several places with success. During the year under report, all the above four, along with Indra Sail and George Sail, were grown extensively all over the Surma Valley. George Sail gave an increased outturn over the local varieties varying from 225 lbs. in Cachar to 519 lbs. in North Sylhet; Indra Sail from 151 lbs. in Habiganj to 519 lbs. in North Sylhet and Lati Sail from 177 lbs. in Cachar to 461 lbs. in North Sylhet. George Sail, Indra Sail and Lati Sail gave an average increase respectively of 358, 353 and 360 lbs. per acre over the whole Valley. All of these gave the best results in North Sylhet.

Among the *aus* varieties, *Murali* gave an average increased outturn of 331 lbs., *Dumai*, 271 lbs. and Katakara 186 lbs. per acre. The results of Cachar, although less marked than in Sylhet, are particularly gratifying, as little progress had been made so far in the district. The eagerness with which the above varieties have been purchased by cultivators, is a sure proof of their superiority. 145·27 maunds of the three *sail* varieties and 57·35 maunds of the *aus* varieties were sold during last year in Surma Valley. In addition to the quantity sold, 76·48 maunds were used for demonstrations, 8·75 maunds were distributed free for trial in new centres in 5 and 10-pound packets. It has been ascertained that many cultivators exchanged ordinary paddy for the improved varieties with cultivators who had grown the improved varieties, and the quantity of improved seeds sown last year very much exceeded, therefore, the actual quantity supplied direct by the Department. A similar process was repeated during the last season and a much larger area is expected to be sown during the coming season. It will thus be seen that, as the process continues, the cultivators will very soon be independent of the departmental supply, so far as paddy is concerned, as it multiplies 40 times. The quantity of seeds supplied direct by the Department does not, therefore, fully represent the influence it exerts in increasing the agricultural wealth of the districts. The table given at the end of this paragraph, shows the quantities of different kinds of improved seeds supplied during the year and the probable area sown with them—which will give some idea of the activities and the possibilities of the Department.

The demand for Shillong potatoes and cuttings of improved sugarcane varieties continued. One thousand and hundred and ninety one maunds of potatoes were supplied in Sylhet and Cachar. On account of the depredation from jackals it has been very difficult to realise the sugarcane

setts supplied to cultivators, as originally proposed. The cost of transport of cuttings from Assam is almost prohibitive, and it is becoming increasingly difficult to arrange for an adequate supply of sugarcane cuttings at a reasonable cost. Cultivators, having proper facilities for protecting their crops, can make considerable profit and render us great assistance by reserving as much of their cane for cuttings as possible. The three roller iron mills and shallow pans are also gaining in popularity; and 58 mills and 13 pans were sold during the year.

One hundred and fifty maunds of Kakaya Bombai jute seeds were obtained in the winter of 1920-21 for supply during the year under report. On account of the fall in the price of jute during recent years, combined with non-co-operation movement, the area under jute was considerably reduced, and, only 37.87 maunds of jute seed were sold at the ordinary rate. A small quantity was sold at a reduced rate but the bulk of the remainder was not sold at all and was practically given away. It is doubtful whether the whole of this was sown. The position has slightly improved during the current year, but the area will be still considerably below the normal.

One particularly gratifying feature of the year's work is the increasing interest which is being taken by the public, both cultivators and middle class *bhadraloks*, in agricultural improvements generally and in the work of the Agriculture Department in particular. It is impossible to mention all names in a report of this size, but a few prominent names have been noted in the last paragraph of this Report. To them as well as to all those whose names it has been impossible to mention but whose work is just as valuable, our grateful thanks are due.

Seeds.	Quantity of seeds supplied by the Department.	Area sown with seed supplied by Seed Deptt direct.	Area sown with seed kept by cultivators.	Total area sown with improved seeds.	Total increased outturn.	Value of total increased outturn.	Remarks.
1	2	3	4	5	6	7	8
		Acres.	Acres.	Acres.	Mds.	Rs.	
Paddy	309 mds. ...	494	3,032	3,526	17,690	48,462	Paddy at Rs. 2-12 per maund.
Jute	67 mds. ...	670	...	670	2,019	8,040	Jute at Rs. 4 per maund.
Groundnut	13½ mds ...	25	...	25	375	4,500	Introduction. Groundnut at Rs. 12 per maund.
Potatoes	1,439 mds....	120	...	120	2,130	6,390	Potatoes at Rs. 3 per maund.
Tobacco	783 pkts. ...	32	...	32	96	1,920	Tobacco at Rs. 20 per maund.
Sugarcane	40,000 setts	5	20	25	900	2,100	Gur at Rs. 7 per maund.
Total	...	...	...	...	...	71,482	

4. The demonstrations carried out consisted of the following items:—

1. Manurial demonstrations.

2. Introduction of superior varieties of paddy.
3. Ditto ditto ditto jute.
4. Ditto ditto ditto Shillong potatoes.
5. Ditto ditto ditto sugarcane.
6. Ditto ditto ditto pulses and oil seeds.
7. Ditto tobacco and miscellaneous new crops.
8. Ditto three roller iron sugarcane mills, shallow pans and miscellaneous implements.

9. Utilisation of natural manures, including water hyacinth Ash.

5. The manurial demonstrations on paddy consisted of the following:—

Manurial demonstrations on paddy.

- (a) Bonemeal.
- (b) Bonemeal and dhaincha on soil paddy.
- (c) Dhaincha alone on soil paddy.
- (d) Bonemeal and oilcake.

Bonemeal was applied at the rate of 247 lbs. (3 maunds) and oilcake at the rate of 494 lbs. (6 maunds) per acre. *Dhaincha* was sown at the rate of 30 lbs. per acre and ploughed in about two weeks before transplanting. A partial stand of *dhaincha* in most plots was obtained this year. The plots in which manures were applied in 1919 and 1920 were also kept under observation and the results recorded. The results of the various manures in the different localities are shown in the following tables:—

TABLE I
APPLIED IN 1921.

Kind of treatment.	Number of demonstrations.	Average increase in output in lbs. per acre.	Value of increased crop per acre at Rs. 2-12 a maund.	Cost of manuring	Profit or loss.	Remarks.
1	2	3	4	5	6	7
			Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bonemeal	5	329	11 0 0	15 0 0	4 0 0	Loss—North Sylhet.
	2	252	8 6 9	15 0 0	6 9 3	Loss—Karimganj.
	6	524	17 8 0	15 0 0	2 8 0	Profit—South Sylhet.
	2	53	1 12 3	15 0 0	13 3 9	Loss—Habiganj.
	6	316	10 9 0	15 0 0	4 7 0	Loss—Cachar.
Total	21	2948	9 13 6	15 0 0	5 2 6	Loss average.
Dhaincha	1	373	12 7 6	1 12 0	10 11 6	Profit—North Sylhet.
	2	318	10 10 0	1 12 0	8 14 0	Profit—South Sylhet.
	2	24	0 12 9	1 12 0	0 15 3	Loss—Cachar.
Total	5	23333	7 15 6	1 12 0	6 3 6	Profit average.
Bonemeal and dhaincha.	4	519	17 5 6	16 12 0	0 9 6	Profit—Karimganj.
	4	848	11 10 0	16 12 0	5 2 0	Loss—South Sylhet.
	1	5	0 2 9	16 12 0	16 9 3	Loss—Habiganj.
	3	191	6 6 0	16 12 0	10 6 0	Loss—Cachar.
Total	12	26575	8 14 0	16 12 0	7 14 0	Loss average.

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TABLE II.

Applied in 1920.

Kind of treatment.	Number of experiments.	Average increase in lbs. per acre.			Value of increased crop at Rs. 2-12-0 per maund.	Cost of manuring.	Profit or loss.	Remarks.
		1911.	1920.	Total.				
1	2	3	4	5	6	7	8	9
Bonemeal ...	2	171	343	514	17 2 9	15 0 0	2 2 9	Profit—North Sylhet.
	4	335	550	885	29 9 3	15 0 0	14 9 3	Profit—Karimganj.
	1	91	317	408	13 7 6	15 0 0	1 8 6	Loss—South Sylhet.
	2	300	518	818	27 5 6	15 0 0	12 5 6	Profit—Habiganj.
	2	150	366	516	17 4 0	15 0 0	2 4 0	Profit—Cachar.
	11	309-40	418-90	628-30	30 15 8	15 0 0	5 15 8	Profit average.
Bonemeal and Dac inches.	1	288	266	1,125	27 15 0	16 12 0	21 3 0	Profit—South Sylhet.
	2	297	29	325	10 13 9	16 12 0	5 14 3	Loss—Cachar.
	4	591	120	730	24 6 3	16 12 0	7 10 3	Profit average.
Bonemeal and oil-cake.	4	217	576	793	25 6 0	22 8 0	4 0 0	Profit—Karimganj.
	2	461	512	973	22 6 3	22 8 0	10 0 3	Profit—South Sylhet.
	2	165	101	246	8 3 6	22 8 0	14 4 6	Loss—Habiganj.
	5	274-35	288-25	670-65	22 6 6	22 8 0	0 1 6	Loss.
Bonemeal ...	1	164	...	164	5 8 8	1 12 0	5 12 0	Profit—Cachar.

TABLE III.
Bonemeal applied in 1919.

Kind of treatment.	Number of demonstrations.	Average increase in pounds per acre.		Total increase of crop.	Value of increased crop.	Cost of manuring.	Profit or loss.	Remarks.
		1921.	1919 and 1920.					
1	2	3	4	5	6	7	8	9
Bonemeal	1	241	890	1,131	Rs. a. p. 37 12 9	Rs. a. p. 15 0 0	Rs. a. p. 22 12 9	Profit—Karinganj.
	1	195	638	833	28 8 3	15 0 0	13 8 3	Profit—Habiganj.
	2	115	624	639	21 6 9	15 0 0	5 6 9	Profit—Cachar.
	4	183.67	600.66	874.83	29 5 9	15 0 0	14 5 9	Profit average.
Bonemeal and Dhaincha.	1	243	1,017	1,260	42 1 9	16 12 0	25 8 9	Profit—North Sylhet.
	1	28	673	601	30 1 9	16 12 0	13 8 9	Profit—Karinganj.
	1	68	346	414	13 13 6	18 12 0	2 14 6	Loss—Habiganj.
	2	179	1,169	1,347	45 2 9	16 12 0	28 6 9	Profit—Cachar.
	5	129.25	831.25	980.50	32 13 9	16 12 0	16 1 9	Profit average.
Bonemeal and oil-cake.	1	451	777	1,228	41 0 9	22 8 0	18 8 9	Profit—South Sylhet.
	1	195	350	545	18 3 6	22 8 0	4 4 6	Loss—Habiganj.
	2	323.00	553.50	836.50	29 10 0	22 8 9	7 2 0	Profit average.
Limestone and Dhaincha.	1	56	100	156	5 3 6	11 12 0	6 8 6	Loss North Sylhet.
	2	159	60	218	7 4 6	11 12 0	4 7 6	
	3	107.00	80.00	197.00	6 4 0	11 12 0	5 3 0	Loss—Cachar. Loss average.

The results are in general agreement with those obtained in previous years. With the present high price of bonemeal its application is rarely profitable in the first year but brings in a small profit in the second and third years. It is generally found more profitable in combination with an organic manure. *Dhaincha* is generally profitable in single cropped land and as it is an inexpensive manure its use is to be recommended for wider adoption. But the difficulty is to ensure a stand before the monsoon sets in, as *dhaincha* makes little growth after the rains have definitely started. The practice of sowing *dhaincha* immediately after the winter paddy is harvested, has given very satisfactory results in the Karinganj Farm and this will be tried more extensively next year. In all manurial demonstrations, a good deal depends on the proper choice of the plots. Even on the experimental farms where conditions are under much stricter control,

the results of two contiguous plots vary for inexplicable reasons, which can be only explained by an inherent difference in the plots themselves. Too much reliance cannot, therefore, be placed on the above figures, taken by themselves, but they may be taken as general indications of the effects of the manures.

6. With a view to introducing superior varieties of paddy, Indra Sail, George Sail and Lati Sail were tested against the local varieties in all the demonstration centres in Sylhet and Cachar. They showed their superiority everywhere except on a few plots at Habiganj where Indra Sail gave negative results in one centre and George Sail in two centres. These results were probably due more to the local variations in plots than to the seed. Indra Sail and George Sail have also been found to do quite well in various centres in Cachar. The local conditions have now been studied more thoroughly to which the improved results might be due. Lati Sail, a Karimganj Farm selection, was more extensively tried all over the valley with very good results. It suits the comparatively high land which is generally not suited for Indra Sail and George Sail. The cultivators appear to have a particular liking for the variety—probably because it is suited to a variety of soils, ripens earlier and the grain is of medium size. Two hundred and twenty-nine and a half maunds of the above three varieties are being issued for seed during the present season. The results of comparative outturns are given below :—

Varieties.	Number of demonstrations.	Average outturn per acre.	Average outturn of local paddy per acre.	Average increase per acre.	Profit (paddy at Rs. 2 12-0 per maund).	Remarks.
1	2	3	4	5	6	7
Indra Sail	5	1,761	1,102	599	20 0 3	Profit—North Sylhet.
	6	2,230	1,782	457	15 4 3	Profit—Karimganj.
	5	2,229	1,540	350	12 0 0	Profit—South Sylhet.
	5	1,970	1,782	151	5 0 9	Profit—Habiganj.
	2	2,616	2,450	866	12 3 9	Profit—Suzanganj.
	17	2,260	2,070	190	6 5 6	Profit—Cachar.
	40	2,219-00	1,865-35	333-67	11 13 0	Profit average.

Varieties.	Number of demonstrations.	Average outturn per acre.	Average outturn of local paddy per acre.	Average increase per acre.	Profit (paddy at Rs. 2 12-0 per maund).	Remarks.
1	2	3	4	5	6	7
George Sail		lbs.	lbs.	lbs.	Rs. a. p.	
	5	2,243	1,724	519	17 5 7	Profit—North Sylhet.
	8	2,622	2,168	454	14 8 0	Profit—Karimganj.
	5	2,251	1,913	338	11 4 9	Profit—South Sylhet.
	14	1,746	1,419	327	10 14 9	Profit—Habiganj.
	1	2,926	2,620	306	10 3 6	Profit—Sunamganj.
	14	2,020	1,795	225	7 8 3	Profit—Cachar.
	47	2,301.33	1,943.16	358.17	11 15 6	Profit average.
Lati Sail	6	1,857	1,396	461	15 6 6	Profit—North Sylhet.
	10	2,518	2,037	481	16 1 3	Profit—Karimganj.
	6	2,634	2,209	425	14 3 3	Profit—South Sylhet.
	9	1,699	1,440	259	8 10 6	Profit—Habiganj.
	11	2,322	2,345	177	5 14 6	Profit—Cachar.
	42	2,246.00	1,885.40	360.60	12 0 9	Profit average.

Trials of the *aus* varieties, *murali* ³⁶/₃₆, *Dumai* ¹³⁸/₆ (a quick growing variety) and Kataktara were extended to all the centres. The first two are Karimganj Farm selections and the third a Dacca Farm selection. With a few negative results against *murali* and Kataktara, the yields are most encouraging. In addition to the above, C. P. *Aus* (a variety of Central Provinces, more or less acclimatised in Dacca) was tried in a few places for the first time. There were six trials which gave an average out-

turn of 1,260 lbs. per acre. On account of the fineness and white colour of the kernel it has proved very popular, and all the produce have been kept by the cultivators for seed. Thirty-five maunds of the above varieties are being issued for seed during the coming season. The results of the comparative outturns are given below :—

Varieties.	Number of demonstrations.	Average outturn per acre.	Average outturn of local paddy per acre.	Average increase per acre.	Profit (paddy at Rs. 2-12-0 per maund).	Remarks.
1	2	3	4	5	6	7
Katakata	3	1ba. 2,365	1ba. 1,742	1b. 683	Rs. s. p. 20 13 3	Profit—North Sylhet.
	2	1,061	1,312	311	10 6 3	Loss—Karimganj.
	3	1,960	1,465	495	16 8 9	Profit—South Sylhet.
	6	1,721	1,794	63	2 1 9	Loss—Cachar.
	14	1,761-75	1,575-75	186 00	6 3 6	Profit average.
	6	1,337	995	332	11 1 6	Profit—North Sylhet.
St. Murali	6	1,363	1,113	240	8 5 3	Profit—Karimganj.
	6	2,002	1,725	277	9 4 0	Profit—South Sylhet.
	6	1,576	1,075	501	16 12 0	Profit—Habiganj.
	8	1,985	1,658	327	9 14 6	Profit—Cachar.
	22	1,644-40	1,313-20	331-20	11 1 0	Profit average.
	2	741	439	311	10 6 3	Profit—North Sylhet.
St. Dumal	3	1,278	1,046	232	7 12 0	Profit—Karimganj.
	3	1,009-50	228-00	271-50	9 1 0	Profit average.

7. The superiority of Kakaya Bombai has now been established in the jute-growing portions of Sylhet. The work now really consists in introducing the particular variety in new localities and pushing its supply in the existing jute-growing centres. The season was extremely unfavourable for jute throughout the Valley, which was responsible for the destruction of many plots. The crop of the remaining plots were very much stunted and the results are not of much value.

8. The climatic conditions were unfavourable for the sugarcane crop also. Timely ploughing and inter-culture were greatly interfered with on account of excessive rains in the cultivation season; the crops, however, grew fairly well but were badly damaged by jackals towards the ripening period. Unless some effective means can be devised to combat this evil, it will be impossible to establish the improved varieties in this Valley, as, on account of their soft skin, they suffer much more damage from the depredation of jackals than local varieties. This makes it also difficult to obtain accurate records of the comparative outturns in the demonstration plots and to realise sugarcane setts. Results, as far as they could be obtained, are given below :—

Varieties of cane.	Average yield of <i>gur</i> per acre in pounds.		Remarks.
	In Cachar.	In Sylhet.	
1	2	3	4
Striped Mauritius	5,853	2,614	
B376	3,865	...	
Dhal	3,623	2,396	

In Sylhet there is a practice of selling the whole cane and juice instead of manufacturing the juice into *gur*. An acre under B376 gave a gross income of Rs. 422 against Rs. 238 from the local Kejoo, and in another the outturn of juice of B376 was 23,927 lbs. against 12,396 lbs. of Dhal and Kejoo.

The supply of the superior varieties of sugarcane was hopelessly inadequate. Most of the people kept all the cuttings they could secure for their own use and sold the balance to their neighbours. Altogether 25,000 cuttings have been distributed during the year.

9. The potato demonstrations consisted of the trial of the selected Shillong varieties against local varieties and of a comparison of large size against the small size in general use in the plains. The demand for Shillong varieties is increasing every year and the varietal demonstrations were only arranged in places where the cultivation of potato was comparatively recent and capable of rapid expansion. The potato crop suffered a good deal on account of prolonged drought in the growing season, and the outturns were consequently not very satisfactory. The actual results obtained were as follows:—

Place.	Number of Demonstrations.	Yield of potatoes in pounds per acre.				Remarks.
		Superior variety.	Bhola-ganj.	Local.	Average increase per acre.	
1	2	3	4	5	6	7
North Sylhet ...	7	9,043	6,385	...	2,658	
Karimganj ...	2	7,168	5,062	...	2,106	
South Sylhet ...	9	7,886	...	6,206	1,680	
Habiganj ...	10	4,076	...	3,620	456	
Average	...	7,041	5,316		1,725	
Cachar ...	9	4,740	...	3,544	1,196	

In the size tests, an increase of 151 lbs. to 757 lbs. per acre over the small size tubers were obtained. The increase is not very marked and does not pay for the cost of the large tubers, which require about 500 pounds of extra seed per acre, costing over Rs. 40. The work will, therefore, be discontinued and experiments will be conducted at the Karimganj Farm to find out the most suitable size of seed potatoes. Potato was also tried as an entirely new crop in two places in Sunamganj and gave an average outturn of 9,317 lbs. per acre.

Size tests :—

Place.	Yield in pounds per acre.		Average increase per acre.	Remarks.
	Big size.	Small size.		
1	2	3	4	5
North Sylhet ...	8,389	7,774	115	
Karimganj ..	7,034	6,277	757	
South Sylhet ...	7,590	7,760	-170	decrease.
Cachar ...	3,153	3,002	151	

10. *Khesari, Masuri*, Peas and Gram were again tried extensively all over the Valley. Peas and gram gave fairly good outturns, but the results on the whole were, as in previous years, unsatisfactory. Late sowing, due to late rains and continued drought throughout the growing period, were mainly responsible for the results. But, in this Valley, these conditions are the rule rather than exception. The experience of the last three years show that, except in a few special localities, pulses cannot be successfully grown in this Valley without irrigation. It is, therefore, extremely doubtful whether pulses will ever prove a profitable crop in this Valley. The demand for *arhar* seeds has practically died out. The work with pulses in future will consist mainly of supplying the actual demand for seeds. The demand for large grained linseed is increasing. The Assam mustard, however, is not proving much superior to the local seed. As both linseed and mustard are grown extensively throughout the Valley there is considerable scope for improvement and successful work in both of these staples.

11. The tobacco demonstrations consisted of a trial of the superior Rangpur varieties against the local ones and also in attempts at introducing tobacco cultivation in new localities. The work was started in 1920. The services of a special demonstrator, trained in tobacco cultivation, were obtained from Rangpur. The first year's work was rather of a preliminary nature and consisted mainly of tentative trials of the different varieties. There were considerable difficulties in selecting suitable soils and in inducing cultivators of new localities to grow the crop at all. In many cases, the cultivators paid little attention to the crop towards the end of the season. As a result of last year's experience, however it was possible to select suitable sites and cultivators,

and one particular Rangpur variety was tried extensively during the year under report. The results which are given below, have been very encouraging. Tobacco appears to be capable of being grown successfully in most places and as it is a quick growing and paying crop it seems to have quite a good prospect in this Valley where the variety of cold weather crops, now grown, is very limited :—

Places.	Number of demonstrations.	Outturn in lbs. per acre.		Increase in pounds per acre.	Value of increased outturn at Rs. 20 per maund.
		Recom-mended variety.	Local.		
1	2	3	4	5	6
					Rs. a. p.
North Sylhet ...	2	1,095	623	472	114 12 0
Karimganj ...	2	830	577	253	76 1 0
South Sylhet ...	2	1,080	817	263	63 15 0
Habiganj ...	2	818	495	323	78 8 0
Average ...	8	970.75	628.00	342.75	83 5 0

Wheat was tried in various places mainly at the request of local cultivators but gave very poor outturns varying from 110 to 718 pounds per acre. Groundnut was tried in various centres and gave, as before satisfactory results, almost throughout the Valley. The average outturn was 1,284 pounds per acre. The crop has a good future in this Valley.

Various efforts have been made from time to time to induce the cultivators to grow fodder crops but so far without any success. An experiment was made this year to see whether some of the grasses which grow naturally very tall in the rains can be converted into silage. A pit was dug in Chiknagul about 11 miles from Sylhet and filled in October with the long green grass. Since the close of the year a strong gale blew away the shed and the grass was seriously damaged by rains. The silo has since been opened and given to cattle but they refused to eat them. The experiment will be repeated next year. There is little chance of the cultivators paying any attention to fodder crops.

until they keep better animals and there is little prospect of their improving the animals until they pay more attention to their feeding. The problem appears to work in a vicious circle.

12. The three roller iron mills and shallow pans are rapidly coming into general use in this Valley and their use is being demonstrated in new centres in all sugarcane-growing areas. In spite of the increasingly high prices the demand continues unabated. Fifty-eight mills and 13 pans were sold during the year. A large number of applicants had to be disappointed as the mills could not be procured in time.

Use of Meston plough and Planet Junior Hand Hoe were demonstrated in various places, but on account of the high prices there is little demand for these.

13. It is being realised on all hands that unless the plant food of the soil is replenished by the use of manures the higher outturns which are being obtained by the use of improved seeds and improved methods will, sooner or later, drain the soil of its fertility. Use of improved seeds and methods must therefore go simultaneously with the use of manures. The Agricultural Department realised this sometimes ago and is devoting considerable attention in trying to find out cheap sources of manure and bringing them into popular use. In this province at least there is yet considerable scope for the utilisation of the natural manures which may be procured in large quantities and at comparatively little cost. Chief among these are—(a) cow-dung (b) water hyacinth Ash (c) Fish manure.

(a) *Cow-dung*.—Although cow-dung is almost in universal use and its manurial value is widely known, a good deal of its value is wasted by its being kept in heaps, exposed to sun and rain. There are even some places where it is not used at all. Attempts are being made everywhere to induce the cultivators to keep the cow-dung in covered pits. Still greater efforts will be made during the coming season in this direction and definite figures will be kept of the numbers erected.

(b) *Water Hyacinth Ash*.—The work of combating the Water Hyacinth pest has now been transferred to the Local Boards and the function of this Department is merely advisory. The Agricultural Officers are however making a strenuous effort to teach the cultivators the use of the Ash as manure, particularly on jute, potatoes and *mukhi*. A large number of manurial demonstrations with Water Hyacinth Ash were carried out throughout the Valley on the above three crops, the Ash being applied at

6 maunds per acre. The jute crop, as already stated, was practically a failure, but the other results were satisfactory and are given in the following table. The demonstrations will be continued more extensively during the coming season.

Place.	No.	Yield per acre in pounds.			Increase.	Value of increased out-turn. Mukhi at Rs. 1-8 and (potato at Rs. 3).
		Manured with Water Hyacinth Ash.	Manured with Water Hyacinth Ash and bonemeal.	No manure.		
1	2	3	4	5	6	7

MUKHI—(Kachu).

						Rs. a. p.
North Sylhet ...	8	9,753	...	6,844	2,909	53 4 0
Karimganj ...	2	4,260	...	3,533	727	13 8 0
South Sylhet ...	2	3,001	...	2,690	321	6 0 0
Habiganj ...	2	7,600	...	6,591	1,009	18 0 0
Average	...	6,153	...	4,912	1,241	22 8 0
Cachar ...	...	7,591	...	7,351	240	4 8 0

POTATOES.

North Sylhet ...	2	...	21,089	16,520	4,569	166 8 0
Karimganj ...	2	...	7,716	6,630	1,086	39 12 0
South Sylhet ...	1	4,404	...	3,721	683	25 0 0
Habiganj ...	1	5,550	...	5,510	40	1 8 0
Cachar ...	3	4,105	...	3,733	372	13 8 0

N. B.—The ash can hardly be said to have any money value as the destruction of the Water Hyacinth weed is almost imperative.

(c) *Fish manure.*—Sylhet has an extensive fish-drying industry and a large quantity of fish offal, both from the dried fish and from the refuse of the fish, used for extracting oil is now annually wasted. This attracted the attention of the Agricultural Department as early as 1912, but no work could be undertaken for want of staff. Since 1920, however, enquiries are being conducted to find out the manurial values of the stuff as well as the cost likely to be incurred in collecting it in large quantities.

Experiments for determining the manurial value are being conducted at the Karimganj Farm, in Shillong and in a few tea gardens and lands of a few selected cultivators. As the fisheries and *beels* are generally situated in out-of-the-way places, there are considerable difficulties in procuring the manures in large quantities and it will take some time before definite recommendations can be made and the whole thing put on a regular business footing. But the enquiries made so far point to quite hopeful prospects.

14. *Work of Sylhet Seed Depôt.*—Maulavi Fazlul Haque

Staff. Ahmed was on leave for nine months, when Babu

Benode Behari Das, acting Superintendent of Agriculture, held charge of the Sylhet Seed Depôt. The staff consisted of one clerk and one despatcher. It is impossible for the present staff to cope with the rapidly expanding work, and a good deal of the Superintendent's time is taken up in purely routine work. The post of a Head Clerk has been sanctioned and filled up since the close of the year. The permanent despatcher left in the middle of the year, having secured a better appointment and the post has been filled up by an outsider.

15. The Seed Depôt kept up the volume of business transacted last year and disposed of 116·6 tons of seeds and manures, and implements, to the total value of Rs. 31,791-7-6 during the year. The stock in hand, on 31st March, was worth Rs. 10,500-13-6, so that the total value of business transacted was Rs. 45,292-5-0. The articles supplied are increasing not only in number and quantity, but also in variety, as will be seen from the following table which shows the actual supply during the year. Of this 103·28 tons of seeds and manures, and 71 implements of the aggregate value of Rs. 26,767 was actually sold, the rest being supplied to Farms or used for demonstrations.

Seeds—

		Mds.	s.	ch.	Ton.	lbs.	oz.
Cereals :—							
Oats	...	2	0	0	0	165	0
Wheat	...	3	35	8	0	318	0
Maize	...	0	1	12	0	8	8
Fibres :—							
Buri cotton	...	0	0	4	0	0	8
Cambodia cotton	...	0	4	10	0	1	4
Cotton	...	0	2	0	0	4	0
Garo cotton	...	0	20	5	0	41	10
Mikir cotton	...	0	1	0	0	2	0

		Mds.	srs.	ch.		Tons.	pounds.	oz.
Fodder crops :—								
Berseem	...	0	2	0	0	4	0	
Jowar	...	0	30	0	0	62	0	

Green manure crop :—								
Cowpea	...	0	5	6	0	10	12	
Dhaincha	...	18	0	0	0	1,481	0	
Sunhemp	...	0	36	8	0	75	0	

Implements :—					Nos.
Iron pans	...	...	...	...	13
Meston plough	...	...	...	...	2
Rakes	...	...	...	...	8
Sugarcane mills	...	...	...	...	58

		Mds.	srs.	ch.		Tons.	pounds.	oz.
Manures :—								
Bonemeal	...	1,396	15	0	51.29	0	0	
Castorcake...	...	0	25	0	0	51	0	
Limestone	...	5	0	0	0	411	0	
Mustard cake	...	7	0	0	0	576	0	

Oil-seeds :—								
Groundnut	...	11	25	8	0	962	0	
Linseed	...	9	28	0	0	798	0	
Mustard	...	1	14	8	0	112	0	
Til	...	0	1	0	0	2	0	

Paddy :—								
Badahabbog	...	0	20	0	0	41	0	
Boro	...	3	0	0	0	247	0	
U. P. Aus	...	0	38	8	0	79	0	
Changri	...	6	0	0	0	411	0	

Paddy— <i>concd.</i>	Mds.	srs.	ch.	Tons.	pounds.	oz.
<i>Dumai</i> ...	9	26	8	0	795	0
George Sail.	58	19	8	2.10	0	0
Gowai paddy	2	0	0	0	165	0
Indra Sail ...	128	26	0	4.54	0	0
Kachalat ...	4	2	8	0	334	0
Katakara ...	6	2	8	0	499	0
Kataribhog	0	20	0	0	41	0
King's own	0	20	0	0	41	0
Laki ...	2	20	0	0	206	0
Lambachikan	0	20	0	0	41	0
Lati Sail ...	39	10	0	1.07	0	0
<i>Murali</i> ...	40	29	0	1.49	0	0
Rayda ...	0	4	0	0	8	0

Plants—Grafts—Seedlings:—

	Nos.
Lichi ...	1
Mango ...	1
Pineapple ...	2,000
Sugarcane ...	2,866
Tejpat ...	25

Pulses:—	Mds.	srs.	ch.	Tons.	pounds.	oz.
<i>Arahar</i> ...	24	38	0	0	2,052	0
Gram ...	9	8	8	0	758	0
<i>Khebari</i> ...	50	9	0	1.84	0	0
<i>Mashkalai</i> ...	2	0	0	0	165	0
<i>Masuri</i> ...	28	8	8	1.03	0	0
Peas ...	7	35	0	0	648	0

Roots and tubers:—

Ginger ...	5	18	0	0	448	0
Onion ...	49	11	8	1.81	0	0
Potato ...	1,191	4	0	43.75	0	0
Turmeric ...	5	0	0	0	411	0

Tobacco ...	...	...	...	783 packets.
Vegetable seeds	...	...	...	2,358

It will be seen from the above table that the principal articles supplied were potatoes, pulses, jute, onion, bonemeal and sugarcane mills and sugarcane pans.

Although the quantity of potatoes actually supplied was less than that of last year, the original demand was much greater. One thousand four hundred and thirty-nine maunds of potatoes were purchased for supply and, with the exception of a small quantity sent outside the province, the whole of this was meant for Sylhet. The bulk of the seed was brought down *via* Cherrapunjee and Therriaghat. Unfortunately the late rains delayed the planting season, and the potatoes already brought down suffered heavily from rotting and wastage, causing a severe loss. The price also fluctuated considerably, coming down towards the end of the season when many people gave up the idea of planting potatoes altogether and sowed other crops. The loss caused to the seed depôt by the potato transaction, on account of the above two reasons, amounted to Rs. 2,414. Out of 1,430 maunds actually purchased, 1,191 maunds were sold to the local public, 16 maunds to Honorary Correspondents at concession rates, and 126 maunds were used for demonstrations and experiments. The balance of 248 maunds represent rotting and wastage. Of the quantity sold 378 maunds were sold in Bejura alone.

The demand for sugarcane mills and shallow iron pans continued to increase. The number actually sold were, however, only 58 and 13 respectively, and a few have been sold since the close of the year. The Calcutta Firms which undertook to supply these, failed to give delivery in time and a large number of applicants had to be turned away in the beginning of the season. The sale would have been much greater had there been an adequate and timely supply. It will be necessary to make earlier and more definite arrangements during the coming season.

The demand for bonemeal was practically confined to the Khasi and Jaintia Hills but was much keener than in previous years. One thousand three hundred and eighty one maunds were sold before March. Another 450 maunds was sold early in April. There was a great demand for a further supply, but on

account of the Railway Strike, arrangements could not be made to obtain a sufficient supply in time. The price at Calcutta also fluctuated a good deal. As the demand for bonemeal is increasing rapidly and as there is no other agency which can take up the business, it will be necessary for us to make better arrangements for obtaining our supply of bonemeal as well as of sugarcane mills. There was a great set-back in the sale of jute seed. To obtain a sure supply of jute seed it is necessary to arrange during the previous season—about a year in advance of the actual requirements—as Kakaya Bombai jute seed cannot be purchased ordinarily in the market. As there was a great demand for Kakaya Bombai jute seed during the previous two years, arrangements had been made in the spring of 1921 to grow 150 maunds of jute seed. The unfavourable weather during the sowing season of 1921, the activities of the non-co-operators and the continued low price of jute during the last two years, all combined, materially reduced the area under jute; 33 maunds were sold for Rs. 381, 50 maunds supplied for demonstration and distribution in small free packets and the balance had practically to be thrown away, causing a loss of Rs. 1,153. Sixty-nine maunds of jute seed was obtained for the present year, but it is proposed not to purchase large quantities in the future.

16. The accompanying balance sheet shows a gross receipt of Rs. 32,235-2-0 and a gross expenditure of Rs. 34,791-7-6, including charges for establishment, rent, depreciation, etc., resulting in a net loss of Rs. 2,556-5-6 on the year's working. As has been stated before, the transaction in potato and jute seed were responsible for a loss of Rs. 3,567 but for which the seed depot would have shown a *plus* balance sheet of Rs. 1,011. With the exception of Rs. 548-8-9, the whole of last year's outstanding bills have been realised. Out of the unrealised amount Rs. 199-3-3 have been written off, Rs. 27-4-0, has since been realised and it is hoped to realise the balance very soon. Out of the outstanding bills of the year under report Rs. 1,167-12-0 has already been realised since the close of the year and Rs. 562 is due from the Bejura Co-operative Society, leaving a sum of Rs. 21 only, which will be realised within the next few days. The Bejura Co-operative Credit Society is negotiating for a loan from the Provincial Bank and our bill will be paid off as soon as the loan is received. It is to be very much regretted however, that most of the outstandings are due from well-to-do people, who could easily pay off the amounts without much difficulty. As a matter of courtesy, the railway receipts were not sent per value payable post to them, but the practice must be discontinued in future.

Receipts and expenditures.

Assets or receipts.		Liabilities or charges.	
	Rs. a. p.		Rs. a. p.
Total amount of sale-proceeds ...	27,893 7 5	Rents ...	900 0 0
Deduct outstanding of last year ...	2,414 9 5	Establishment ...	768 5 2
Receipts of current year...	25,479 4 0	Contingencies including freight and packing charges ...	1,067 11 6
Add advance received last year and adjusted ...	86 5 0	Add credit note charges not yet adjusted ...	720 4 0
Bills outstanding ...	1,760 8 9	Purchase of stores ...	34,247 8 11
Value of stores supplied to Honorary Correspondents at concession rates ...	94 1 0	Cost of stores received free from Farms, etc. ...	995 13 9
Value of stores supplied to Farms, Gauhati Seed Depot and demonstrations ...	4,825 15 3	Depreciation in value of stock in hand at 10 per cent. of cost price ...	1,050 1 6
			39,137 12 10
		Deduct advance for bone-meal ... Rs. 1,982 9 6	} 2,456 4 7
		Deduct advance for seed potatoes ... Rs. 473 11- 1	
			36,681 8 3
		Value of stock in hand on 1st April 1921, after allowing 10 per cent. depreciation ...	8,610 12 9
		Value of stock in hand on 31st March 1922 ...	10,500 13 6
		Increase in stock ...	1,890 0 9
		Total Expenditure ...	34,791 7 6
		Loss ...	2,556 5 6
Total Receipts ...	32,395 2 0	Net Expenditure ...	32,235 2 0

AGRICULTURAL DEMONSTRATIONS IN THE KHASI AND JAINTIA HILLS DURING THE YEAR 1921-1922.

17. Mr. L. L. Reade was in charge of the Demonstrations in the Khasi and Jaintia Hills throughout the year. He was also in charge of the duties of the Fruit Inspector. He was assisted by 4 Demonstrators who are stationed at Shillong, Jowai, Mawphlang and Nongpoh respectively. Glosoun Singh, the Demonstrator in charge of the Bhoi circle (Umran) died on the 30th April 1921 and Sedro Singh, a trained apprentice, was appointed in his place with head quarters at Nongpoh. Very little progress was made in the Bhoi circle, as there has been frequent changes in the personnel of the Demonstrators since the work was originally started there, and the present Agricultural Demonstrator is not yet thoroughly acquainted with the local cultivators of the circle.

The Agricultural Inspector was on tour for 242 days and frequently visited all the centres where demonstrations were being carried out. He also attended the Annual Auxiliary Force Camp held at Dibrugarh from 18th to 25th February 1922. Besides supervising and organising the bonemeal and potato demonstrations, the greater part of his time was taken up in arranging for the supply of seed potatoes for the plains districts and in distributing bonemeal in the Khasi and Jaintia Hills.

18. The Demonstrations consisted of the following principal

Demonstrations.
items :—

- (1) Manurial demonstrations with bonemeal on paddy.
- (2) Potato demonstrations.
- (3) Trials of new varieties of paddy and miscellaneous crops.
- (4) Up-keep of Orchards and distribution of plants.

Paddy manurial demonstrations.—The majority of the wet land paddy cultivators in the more accessible parts of Jowai, Shillong and Mawphlang circles have realised the value of bonemeal as manure for wet land paddy. Fresh demonstrations have been carried out only in localities where its value has not yet been fully realised.

There were 9 demonstration plots of $\frac{1}{2}$ acre each, the bonemeal being applied at 247 lbs. per acre. One plot was destroyed by hailstorm and the results of the other plots are given below :—

Locality.	Cultivator.	Yield of grains in lbs. per acre.		Excess yield in lbs. per acre.	Remarks.
		Treated.	Untreated.		
1	2	3	4	5	6
Shangpung ...	U Span ...	1,834	1,245	589	
Diengkynthong ...	U Had ...	1,992	1,494	498	
Pynthar ...	Baton ...	1,518	1,163	355	
Umkren ...	Sumar ...	1,223	1,144	79	
Nongksah ...	Edrik ...	1,319	1,021	298	
Umsaw ...	Delington ...	2,490	1,732	758	
Sumare ...	Kpa U El ...	2,281	1,660	621	
Mawhita ...	Pynarp ...	1,704	1,000	504	
	Average ...	1,770.12	1,307.75	462.37.	

Rs. a. p.

Cost of manure per acre, at Rs. 7-12 per maund ... 23 4 0

Value of increased outturn per acre at Rs. 6 per maund. 33 10 0

Net profit per acre ... 10 6 0

It will thus be seen that there is a profit even in the first year and any profits in the subsequent years is clear gain.

The following plots, originally manured in 1920 and 1919, were kept under observation and the results are given in the two following statements. One of the plots in each series was destroyed by hailstorm and is omitted from the table.

Manured in 1920.

Locality.	Cultivator.	Yield of grain in pounds per acre.		Excess yield in pounds per acre.	Excess of yield in 1920.	Increase in 2 years.
		Treated.	Untreated.			
1	2	3	4	5	6	7
Ummawlong...	U Well ...	1,676	1,079	597	Lbs. 486	1,083
Pamra ...	U Don ...	1,227	1,099	128	680	708
Umsawmat ...	Debi ...	1,282	1,157	125	172	297
Mawlong ...	Tishon ...	1,601	1,489	112	581	693
Waaryngap ...	Kpa Ka Le	1,174	1,058	116	351	467
Khuan ...	Kpa Ebet ...	1,319	1,166	153	465	618
	Average ...	1,379.83	1,174.66	205.17	429.16	644.33

Manured in 1919.

Locality.	Cultivator.	Yield of grain in lbs. per acre.		Excess yield in lbs per acre.	Remarks.
		Treated.	Untreated.		
1	2	3	4	5	6
Byrjai ...	Pring ...	1,103	996	107	
Lyngkien ...	Lity... ..	1,326	1,162	164	
Kynshi ...	Junom ...	1,172	1,123	49	
Myiliem ...	Wellington ...	1,120	1,109	11	
Nongpoh ...	Basir ...	1,581	1,545	36	
	Average ...	1,200.40	1,187.00	73.40	

The combined result, for the last three years, of the plots originally manured in 1919, are given below :—

Locality.	Excess of outturn per acre of manured and unmanured plots.				Cost of manure.	Price of increased outturn.	Net profit.
	1919.	1920.	1921.	Total for three years.			
1	2	3	4	5	6	7	8
	lbs.	lbs.	lbs.	lbs.	Rs. a p.	Rs. a p.	Rs. a p.
Myllem ...	336	124	11	471	...	...	...
Lyngkien ...	223	282	164	649	...	...	...
Kynshi ...	471	343	49	863	...	...	...
Byrjai ...	475	335	107	917	...	...	...
Nongpyoh ...	425	311	36	772	...	...	...
Average ...	336	275	73.4	734.4	23 4 0	53 8 0	30 4 0

It might be mentioned that the bonemeal has been valued at its present price, whereas it was really cheaper three years ago, when it was actually applied. In many cases the application of bonemeal means not merely an extra profit but the difference between no crop and a very fair crop.

In Khasi Hills alone the area under wet land paddy is 13,000 acres. If arrangements could be made to apply bonemeal to the whole of even this comparatively small area, there would be an annual net gain of over Rs. 100,000 in this district, and the gross production of the Khasi and Jaintia Hills would be increased by over two lakhs of rupees per annum. There is no doubt that by the application of bonemeal, paddy could also be grown profitably on a much larger area than at present. If similar operations could be carried out in the Lushai and Naga Hills, the wealth of the hills could, perhaps, be increased by nearly half a crore of rupees annually.

During the year, 1,404 maunds of bonemeal (54.8 tons) including 770 maunds purchased last year were sold in the Khasi Hills, although the price at Shillong went up to Rs. 8 per maund. This was the maximum quantity disposed of in any one year in the Khasi Hills. The prices of bonemeal fluctuated a good deal at Calcutta and this added considerably to our difficulties. There

was a great demand for bonemeal towards the end of the year and an order for another 700 maunds was placed immediately. Although the consignment was despatched early in April, it had not yet been received at the time of writing the report, probably on account of the E. I. Railway strike. If it had been received in time, the whole quantity could have been disposed of within April.

19. *Demonstrations with improved varieties of potatoes.*— These were conducted during the last summer in 6 centres in the high elevation (planted in summer), and three centres in the lower elevation (planted in winter). The results of the demonstrations were as follow :—

SUMMER CROP.

Locality.	Cultivators.	Yield in lbs. out of 82½ pounds seed used.	Remarks.
1	2	3	4
Sohryngkham ...	Mohon ...	372	
Mawput ...	U Er ...	572	
Thangbali ...	U Hed ...	733	
Nongthliw ...	Ka Dre ...	792	
Lawhyrtun ...	Eno ...	605	
	Average...	614.00	

WINTER CROP.

Locality.	Cultivators	Yield in lbs. out of 82½ pounds seed used.	Remarks.
1	2	3	4
Jaintapur ...	Ori ...	593	.....
Nongpoh ...	Basir ...	405	.....
Umsaw ...	Kmi Ka La	61	The crop was destroyed by cattle.

The average yield of potato was fair, although the crop suffered from blight and other diseases throughout the Khasi Hills as in the previous year.

The local varieties of potatoes in the district (Khasi Round and Magnum Bonum) are very rapidly dying out and have been almost entirely replaced by the improved Farm varieties. They can now be found in small quantities only in the interior.

Spraying Demonstration.—Demonstrations in spraying with Bordeaux mixture against potato blight (*Phytophthora Infestans*) were carried out in three centres with satisfactory results. During the coming year, it is intended to carry on the spraying operations only at the plots of those cultivators who are willing to pay the expenses of the materials, as its efficiency has been very effectively and widely demonstrated during previous years.

20. *Growing of seed Potatoes*—The practice of issuing seed potatoes from the Farm on "Return system" was continued during the year and the cultivators, besides returning one and half a maund of seed for every maund supplied, undertook to sell the whole of their produce (suitable for seed) to the Department on a small premium of two to four annas per maund over the local rate. During the year, 300 maunds of seed potatoes were issued in summer and 250 maunds in December on this system. Another 24 maunds of seed was issued direct from the Upper Shillong Farm on the same system in March 1922, making a total of 566 maunds grown for seed. Attempts will be made in future to arrange for growing seed potatoes only through big cultivators, so that they may be grown in large and compact blocks. There will be less chance of their intermingling with local varieties and they will be easier to supervise and collect.

Supply of potato seed.—During the year, 3,318 maunds (121·8 tons) were supplied, as detailed below :—

				Mds. s. ch.
Assam Valley	...	...	...	1,290 34 0
Surma Valley	...	...	...	1,427 0 0
Khasi Hills	...	...	...	594 26 0
Outside the Province	...	...	...	5 20 0
				<hr/> 3,318 0 0

The prices were very high and the weather during transport rather unfavourable, otherwise the demand would have been even greater. Mr. Birt prepared a short note regarding the potato crop in Shillong, for the last meeting of the Board of

Agriculture, and a few extracts from the note will be interesting as showing the results of the activities of the Agricultural Department in this connection.

"The 'Khasi Round' and another variety known as 'Khasi Nanital,' which had been introduced subsequently, were the only varieties under cultivation at that time. Both had become very degenerate and subject to disease; in fact the crop was in great danger of extinction, as will be gathered from the following figures"—

Export of potatoes from Khasi and Jaintia Hills.

1891—1892 ...	...	...	39,000 maunds.
1899—1900 ...	...	...	1,000 „ (less than).

About this time the local Agriculture Department took the matter up and commenced importing seeds from England. The first variety imported was Magnum Bonum which had done so well in the British Isles during the last quarter of the nineteenth century. From then onwards numerous varieties have been imported from Messrs. Sutton & Sons, England, tested for a few years on the experiment station at Upper Shillong and the best of them multiplied and distributed to cultivators. The principal varieties distributed up-to-date are—

Magnum Bonum.
King of Potatoes.
Up-to-date.
Windsor Castle.
British Queen.
Imperator.
King Edward VII.

"The effect of this on the potato-growing industry has been enormous. The export trade increased rapidly until in 1920-21 more than two lakhs of maunds valued at nearly nine lakhs of rupees were exported outside the province from the Khasi and Jaintia Hills alone. To this must be added the export to the plains districts of Assam (figures for which are not available) and the fact that potatoes have become second only to rice as the staple food of the hill people. The old 'Khasi Round' and 'Khasi-Nanital' varieties have practically disappeared from cultivation, having been replaced by the varieties introduced by the Agriculture Department."

21. *Trials of new paddy varieties and miscellaneous.*—Mawsiat Khnam paddy which was distributed in small quantities in different localities has proved superior to other local varieties in the lower and warmer elevation of the paddy-growing tracts.

Ploughing Demonstrations with Meston plough were tried with success on wet land paddy in the Bhoi circle. The use of Turn Wrest plough was again continued in the Bhoi circle, but being a heavy plough, the great difficulty is that suitable bullocks are not available locally.

22. *Orchards and Fruits.*—The American blight has done great damage to some of the apple trees at Mawflong, Upper Shillong, Shillong and Nongbah. The treatment with Mythilated spirit has somewhat checked its progress, but more vigorous steps will have to be taken to stamp out the disease. During the year no other operation was carried out except making the following grafts :—

Pears	...	17	Apples	...	11
Peaches	...	61	Plums	...	99
		Orange (inarching)	52.		

23. *Supply of miscellaneous implements and seeds*—During the year the following implements were supplied to cultivators :—

Secatore	...	...	...	...	4
Grafting knife	...	...	...	...	1
Pruning saws	...	...	...	...	5

The following plants and seeds were distributed during the year :—

Orange seedlings	...	...	...	10,552 plants.
Limes and Lemon varieties	...	...	...	109 „
Coffee seedlings	...	...	...	675 „
Ceylon Pine-apples	...	...	...	3,650 suckers.
Tezpat seedlings	...	...	...	9 plants.
Sohshang (vernacular)	...	...	...	12 „
Soy bean seed	...	...	...	3 lbs.
Oats	...	...	...	83 „
Maize seed	...	...	...	249 lbs.

Botanical Specimens—

Phaius Walachii	...	...	...	12 clumps.
Ground Orchids	...	...	...	12 „
Ja'atynnian (verrucular name)	...	...	...	40 plants.

24. Up till recently it had not been possible to undertake demonstrations in the North-Cachar Hills, systematically, as the whole country, ragged and broken up with steep hills, affords very limited facilities for improved agriculture and is also very deficient in communications. Moreover the conditions are different from those of either Karimganj or Shillong, so at very few

of the results obtained at either of the two experiment stations are applicable here. The problems of North Cachar Hills must be solved locally which will require both time and money. As a beginning a small plot of land was acquired early in 1920, and placed in charge of an Agricultural Demonstrator. The plot is situated about a mile from Haflong town, on the road to the Lower Haflong railway station.

Various crops, such as sugarcane, maize, groundnut, cotton, *Arahar*, wheat, barley and oats are being grown to test their suitability to local conditions.

Among the cereals, oats and maize have done well. Sugarcane has also grown very well, but the cost of manufacturing into *gur* is almost prohibitive. Cotton is grown in *Jhum* cultivation all over the hills and a large number of varieties have been collected and are being compared with the local varieties. A small area has been made fit for paddy cultivation where manurial tests and variety trials will be conducted with paddy.

Haflong is particularly suitable for fruits, and various fruit trees such as orange, pine-apples, plantains have been planted. A few grafts of European fruit trees have also been obtained from Shillong and are thriving well. During the year under report, a small orchard contiguous to the existing plots, formerly belonging to a Gurkha, has been taken over. The place will be extended and developed entirely as an orchard.

A few demonstrations were also tried in the interior and are described below.

Trials with bonemeal on paddy were carried out in two centres with the following results :—

Name of place.	Bonemeal on paddy in pounds per Acre.	No manure in pounds per Acre.	Increase in pounds.
1	2	3	4
Wapoo ...	1,584	1,316	268
Harangajao ...	2,716	2,591	124

A plot manured in 1920 was kept under observation and gave an increased outturn of 184 pounds per acre.

Groundnut gave an outturn of 1,600 pounds per acre at Harangajao.

The three recommended paddy varieties—Lati Sail, Indra sail and George Sail were also tested in Harangajao, without, however, any check plots of local varieties. They gave the following outturn :—

Name of varieties.				Outturn in pounds per Acre.
1				2
<i>Lati Sail</i>	...	...	...	2,308.56
<i>George Sail</i>	...	...	...	1,817.25
<i>Indra Sail</i>	...	...	...	2,193.52

The outturns are very satisfactory. The trials will be conducted during present season with check plots. All the above demonstrations will be continued during the coming year.

It is not possible, however, to extend the demonstrations until a whole-time man is appointed for the Haflong plot, and the present Demonstrator is free to devote all his time to demonstrations.

25. There are 11 Honorary Correspondents in Sylhet and one in Cachar. Mr. Ferguson of Dhamai Tea Estate grew several varieties of paddy and potato, all of which did very well. Maulavi Abdul Waheb of South Sylhet successfully demonstrated the superiority of the improved sugarcane varieties and the efficacy of bonemeal on *Sail* paddy. He also gave considerable assistance in popularising our seeds among local cultivators. Rai Saheb Joynath Nandy, as usual, gave considerable assistance in the sale of potato and jute seed in Bejura and the sales there were carried out practically under his supervision. Maulavi A. Rahim Chaudhury, M.L.C., North Sylhet, and Maulavi A. Mannan Chaudhury of Kanihaty, both grew good crops of Shillong potatoes. Babu Bharat Chandra Das of Silchar got satisfactory results with *Kataktara* Aus paddy. Babu Pavitra Nath Das of Beanibazaar, a substantial Zemindar of Karimganj, has been trying our seeds and manures for a long time on his *Khamar* land and has recently started a farm on a small area. His son, who put in a year at the Sabour Agricultural College has taken charge. The place is about two miles from his home and with proper supervision should be a success. Besides the Honorary Correspondents, members of the local public are now beginning to take a keen interest in

Work of Honorary
Correspondents and
Non-officials.

our work and many non-official gentlemen experimented with our seeds and manures. Babu Harkishore Chakravarty, M.L.C. of Cachar, Maulavi Gyasuddin Chaudhury, a prominent Zemindar of Bhanga, experimented with improved varieties of paddy and sugarcane. Maulavis Monowar Ali, M.L.C. of Sunamganj and A. Khalique Chaudhury, M.L.C. of South Sylhet grew Shillong potatoes. Babu Banewar Sing of Habiganj grew some pulses with success. Babu Surendra Nath Das of Akhalia, North Sylhet, is gradually developing his scattered *Khamar* lands into a compact farm, where he is almost exclusively sowing our seeds. His crops of jute and Shillong potato were highly successful. He has started a small private Dairy and is trying Guinea grass and other fodder crops as a trial. Babu Baikuntha Nath Roy, M.L.C. of Habiganj has offered a piece of land for growing *Aman* and *Boro* paddy and has promised to carry out demonstrations in his Zemindary. Babu Brajendra Kumar Chaudhury of Pailgaon, Sunamganj, one of the biggest Zemindars in the district, has got a large farm of his own, where he is already trying some of our seeds and has promised to give them more extensive and systematic trial during the coming season. In addition to carrying out actual experiments and demonstrations they gave our officers considerable assistance in working among the cultivators. Our grateful thanks are due to all the above gentlemen for the help given.

SYLHET ;	}	J. N. CHAKRAVARTY,
The 15th May, 1922.		Deputy Director of Agriculture, Surma Valley and Hill Districts.

